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de Altas Prestaciones
GRyCAP

Elastic Cloud Compute Cluster (EC3)

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What is EC3?

- EC3 was created with the idea of providing virtual elastic computer clusters on Cloud platforms.

Facilitate access to computing platforms for non-experienced users

Maintain the *traditional* work environment, with clusters configured with a well-known middleware.

Automatic management of elasticity, reducing costs (public cloud) and energy expenditure (private cloud).

Automatic configuration of the application execution environment.

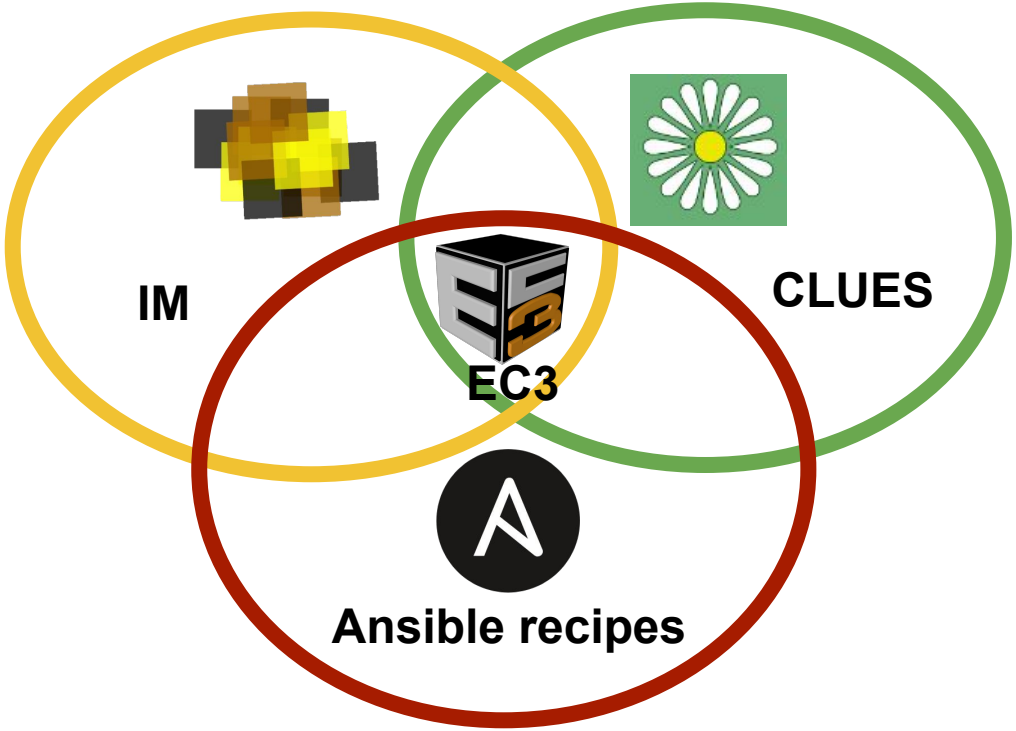
Compatible with a wide range of cloud providers (public, federated and on-premises).

Support for hybrid clusters.

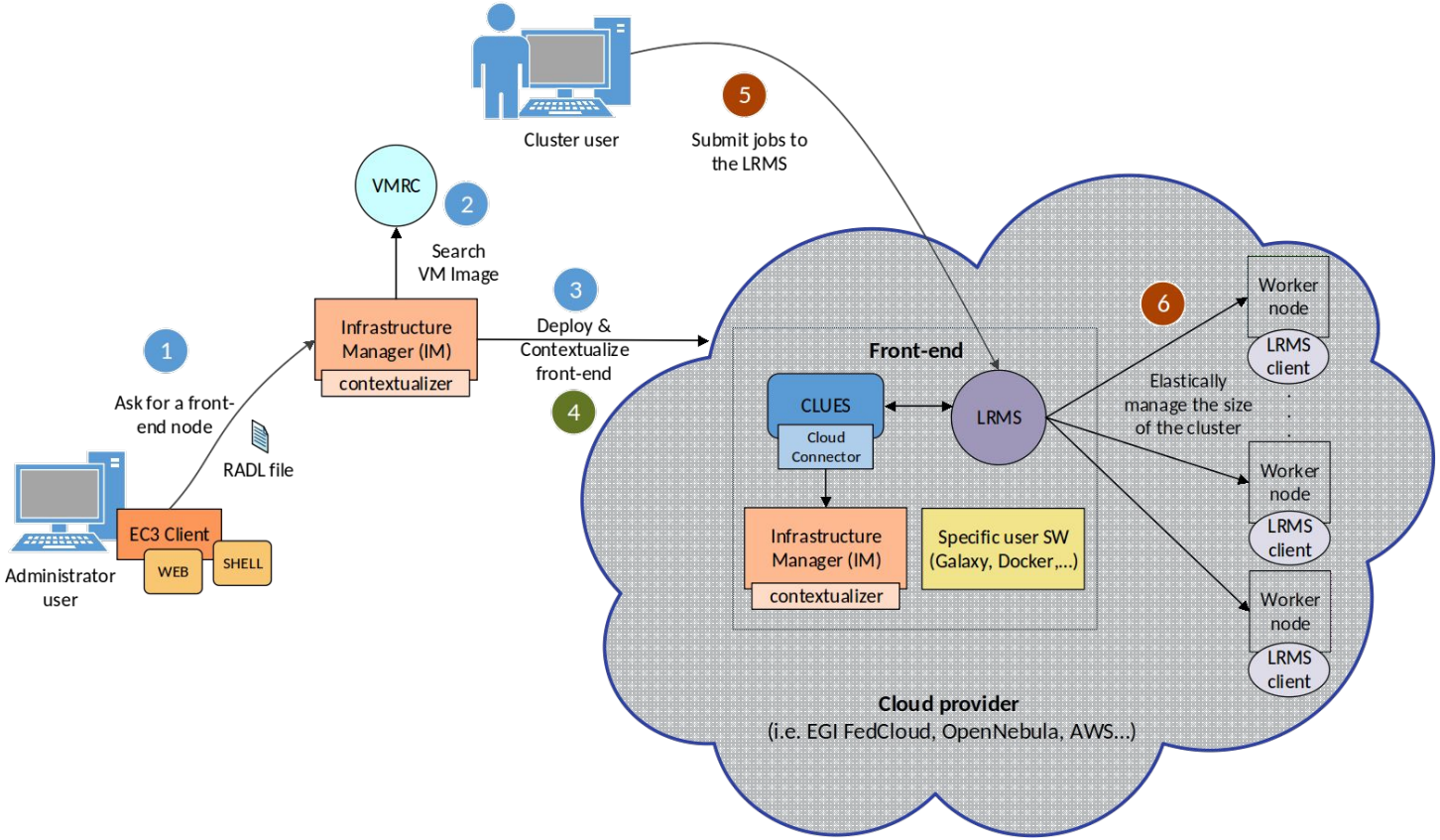
EC3 Components

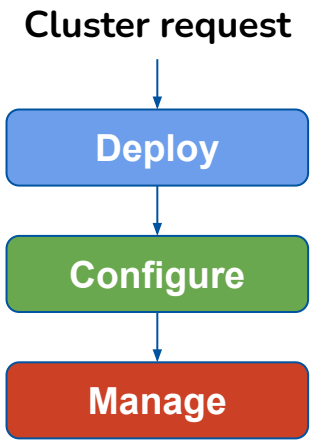
- **EC3** deploys and configures **virtual elastic** clusters. It relies on **IM** to deploy the machines and on **CLUES** to automatically manage the elasticity.

- Offers a set of predefined templates to configure the resources through **Ansible**:
  - Kubernetes, Mesos, SLURM, Torque, SGE, HTCondor, Nomad.

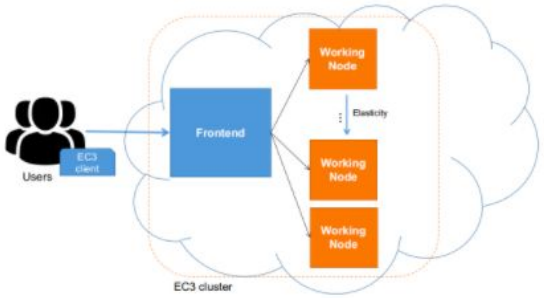


EC3 Architecture

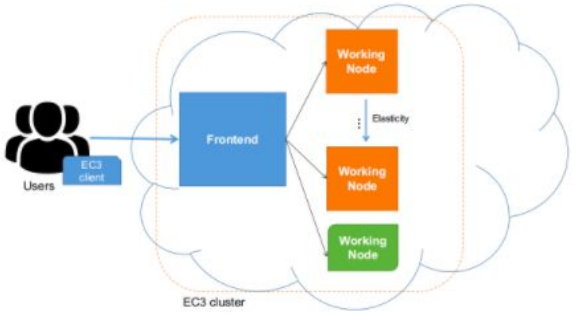




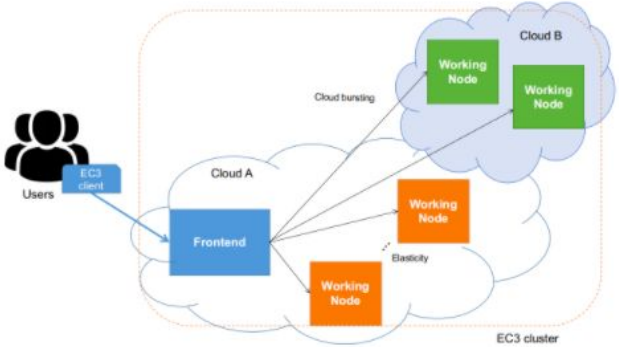
Deployment models



a) Homogeneous cluster



b) Heterogeneous cluster



c) Hybrid cluster

- An **homogeneous cluster** is composed by working nodes that have the same characteristics.
- In an **heterogeneous cluster** the working nodes can have different characteristics (hardware and software). For example, nodes with GPUs.
- **Cloud Bursting** (Hybrid clusters): consists on launching nodes in two or more different Cloud providers. This is done to manage user quotas or saturated resources.

Automatic Elasticity

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Elasticity Management: ability to adapt the size of the cluster to the workload dynamically and automatically, ensuring **transparency**.

- The **elasticity module** is responsible for dynamically adding and removing nodes from the cluster by monitoring the LRMS. **Self-management**.
- Deployment policies (**scale out**):
  - On demand: a node is deployed for each job that comes to the queue.
  - Bursts: deploys a group of VMs for each job in the queue, assuming that if a job arrives at the LRMS, there is an increased chance that new jobs will arrive soon. (i.e HTC applications).
- Undeployment policies (**scale in**):
  - On demand: ends idle nodes when there are no pending jobs in the LRMS queue.
  - Delayed power off: inactive nodes turn off after a certain configurable period of time. (i.e public clouds)

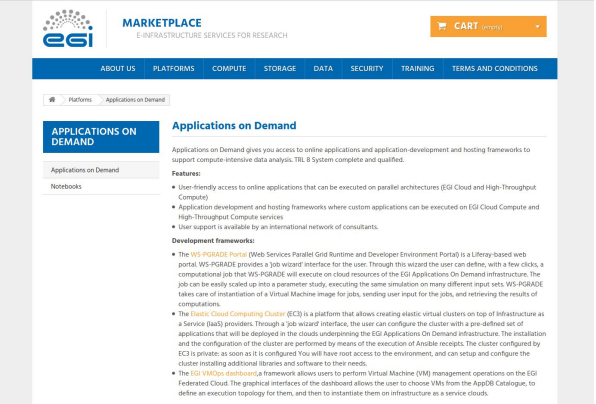
EC3 in the EGI Applications on Demand

- The EGI AoD allows small laboratories and individual researchers the access to a wide range of computational resources and on-line services to manage and analyse large amount of data.
- Inside this service we find the EC3 portal:
  - The EC3 AoD portal enables to launch virtual elastic clusters on top of EGI FedCloud resources using the EC3 tool.
  - It only requires the EGI Check-in account (and vo.access.egi.eu VO) to access to the service.
  - The user is guided step by step in the deployment process.
  - Documentation and tutorials are available, i.e. configuring a Galaxy cluster for data intensive research

EC3 Portal (EGI AoD)

- EC3aaS facilitates the usage of EC3 to non-experienced users:
  - It presents an user-friendly web interface that allows to easily deploy and configure a virtual elastic cluster on EGI Cloud Compute resources.
  - Limited actions: create, list and destroy.

- Documentation: https://ec3.readthedocs.io/en/latest/ec3aas.html



Wizard with 6 simple steps

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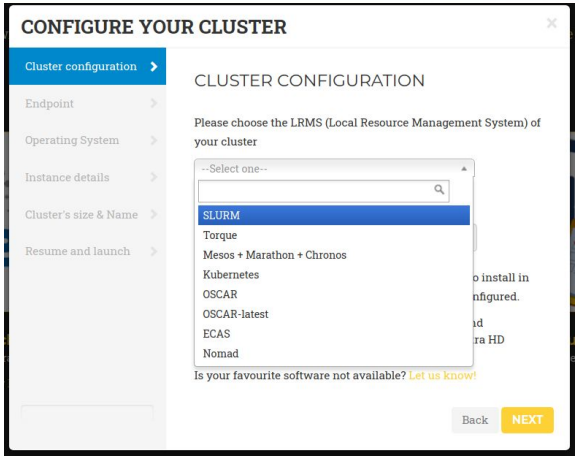

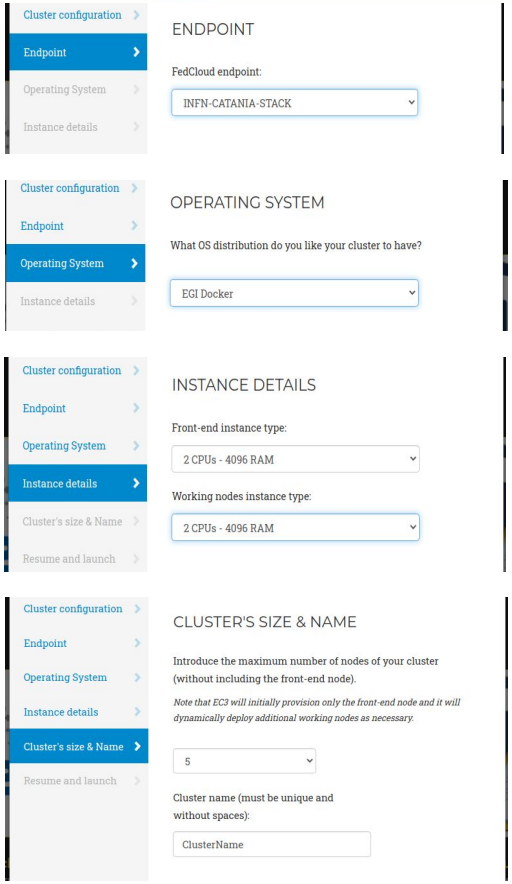

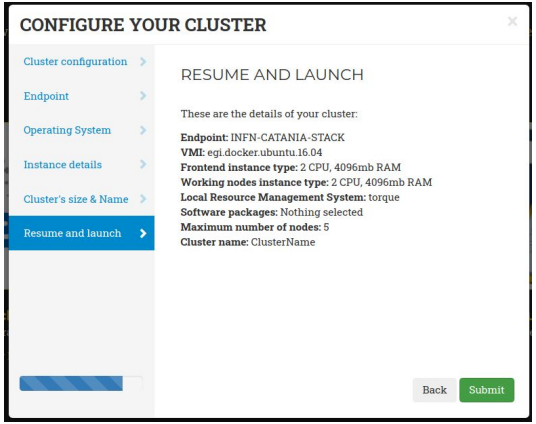

EC3 Client

- More powerful client interface than the Web interface:
  - More control over the cluster (reconfigure, clone, migrate, stop, restart, update).
  - Support for hybrid clusters
  - Support for golden images
- The user needs to define an authorization file
- Documentation: https://ec3.readthedocs.io/en/latest/ec3.html
- EC3 Client Source Code in GitHub: https://github.com/grycap/ec3
- EC3 Client container image available:
  - in Docker Hub:
    - https://hub.docker.com/r/grycap/ec3/
  - In GitHub Container Registry:
    - https://github.com/grycap/im-dashboard/pkgs/container/im-dashboard

EC3 Client (II)


```
usage: ec3 [-h] [-v] [-l LOG_FILE] [-ll LOG_LEVEL] [-q]
           {launch,list,show,templates,ssh,reconfigure,destroy,clone,migrate,stop,restart,transfer,update}
Operation:
      launch          launch a new cluster
      list            list launched clusters
      show            print RADL
      templates       list available templates
      ssh             connect to cluster via SSH
      reconfigure     reconfigure the cluster
      destroy         destroy a launched cluster
      clone           clone a launched cluster in another Cloud provider
      migrate         migrate a launched cluster to another Cloud provider
      stop            stop a launched cluster
      restart         restart a previously stopped cluster
      transfer        transfer a previously launched cluster
      update          update the RADL of the WNs
```

EC3 Client basic example with EGI

First create a file `auth.txt` with a single line like this:

```
id = egi; type = EGI; host = CESGA; vo = vo.access.egi.eu; token = <egi_aai_token_value>
```

Replace `<egi_aai_token_value>` with a valid EGI Checking access token (you can also use oidc-agent).

Create an `ubuntu-cesga.radl` setting the correct URI of the base image to use i.e.:

```
appdb://CESGA/egi.docker.ubuntu.16.04?fedcloud.egi.eu
```

The next command deploys a Kubernetes cluster based on an Ubuntu image:

```
$ ec3 launch mycluster kubernetes ubuntu-cesga -a auth.txt -y

Creating infrastructure

Infrastructure successfully created with ID: 719bd78e-25b0-11ec-8796-de075615d95b
        Front-end state: running, IP: 193.144.46.211
```

Usage examples

- EKaaS: The EKaaS (Elastic Kubernetes as a Service) is an on-demand service to deploy Elastic Kubernetes clusters on the EGI Cloud Compute
  - Demo: https://youtu.be/WAG4VaBMIyI

- OSCAR: is Functions as a Service (FaaS) computing model for file-processing applications. It enables the creation of highly-parallel event-driven file-processing serverless applications that execute on customized Docker containers than run on an elastic Kubernetes cluster.
  - Demo: https://youtu.be/ZtAlVc1uLwc

- Launch a Galaxy Portal configured to use a Torque elastic cluster as computing back-end with EC3 client:
  - Demo: https://youtu.be/qJz5HRsApSI

- SAPS (Surface Energy Balance Automated Processing Service) in EOSC Synergy:
  - Demo: https://youtu.be/mM6xJJRS3Cs

More Information

Video tutorials and demos in YouTube:

https://www.youtube.com/playlist?list=PLgPH186Qwh_1IOesmaTLjd35Q-QqdWf9k

EC3 AoD portal:

https://servproject.i3m.upv.es/ec3-ltos

EC3 in EOSC Marketplace:

https://marketplace.eosc-portal.eu/services/elastic-cloud-compute-cluster-ec3

EC3 official documentation:

https://ec3.readthedocs.io/

EC3 source code:

https://github.com/grycap/ec3

EC3 training course in EOSC Synergy Learning platform:

https://moodle.learn.eosc-synergy.eu/course/view.php?id=14&section=0#tabs-tree-start

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Thank you for your attention!!

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