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EU Brazil Cloud Connect

EU Brazil Cloud Computing for Science

Programming Frameworks

EGI Conference 2015

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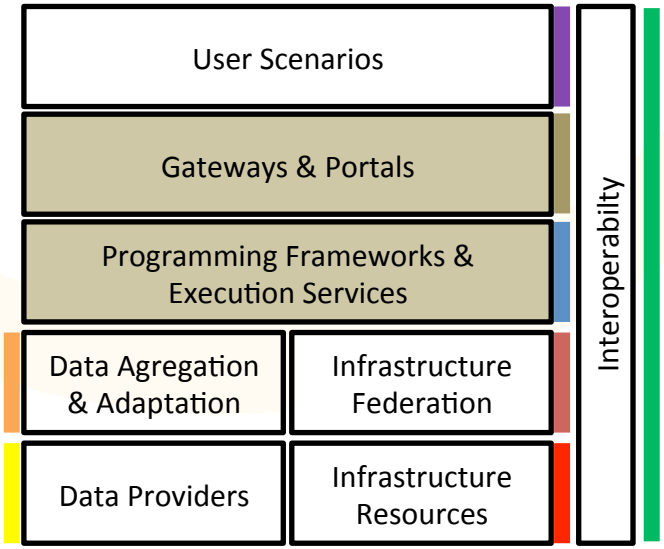
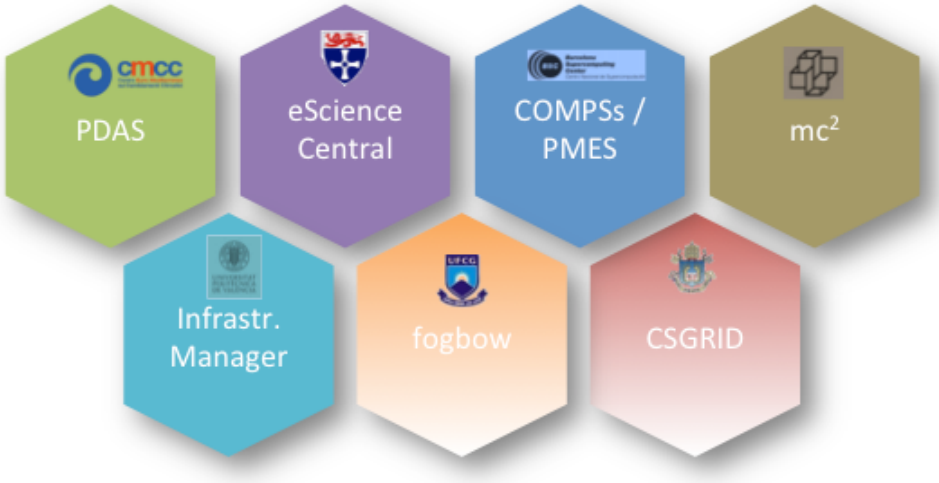
EUBrazil Cloud Connect Architecture

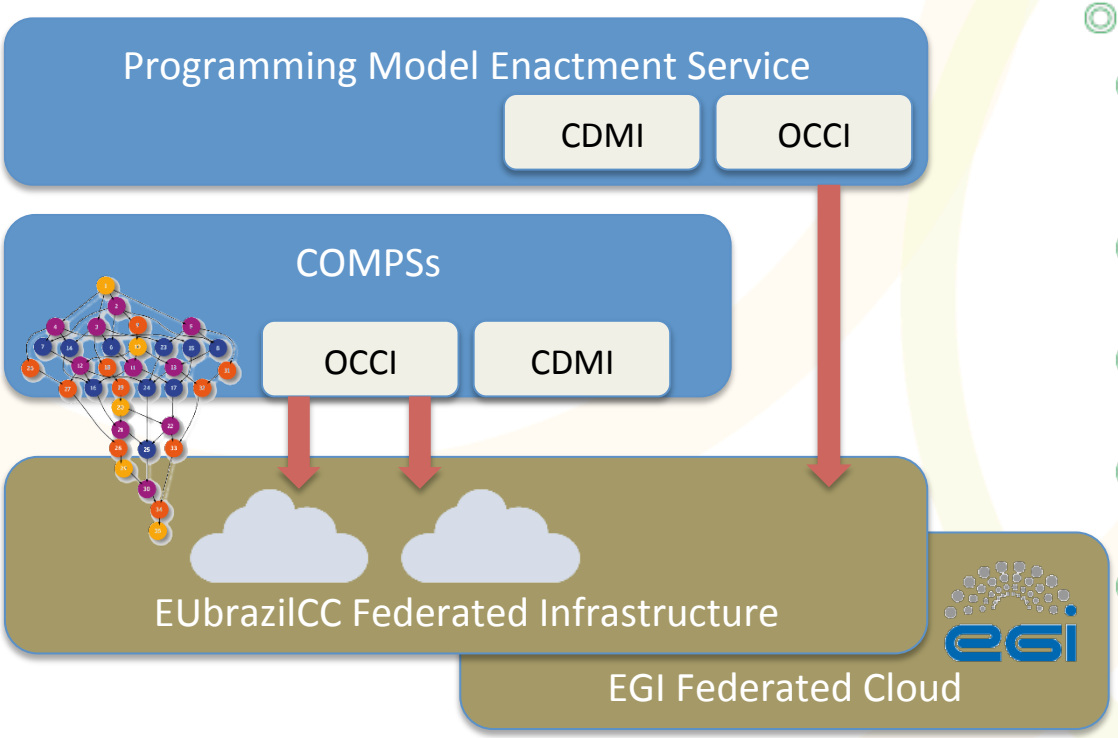
- Provide environments that reduce the development cycle of the use cases
  - Reduce the effort on application porting
  - Platform agnostic applications
- Interoperability with the infrastructure
  - Transparent deployment of the applications using the available programming frameworks and services
  - Integration through standards (OCCI, CDMI, x509)





Programming Frameworks

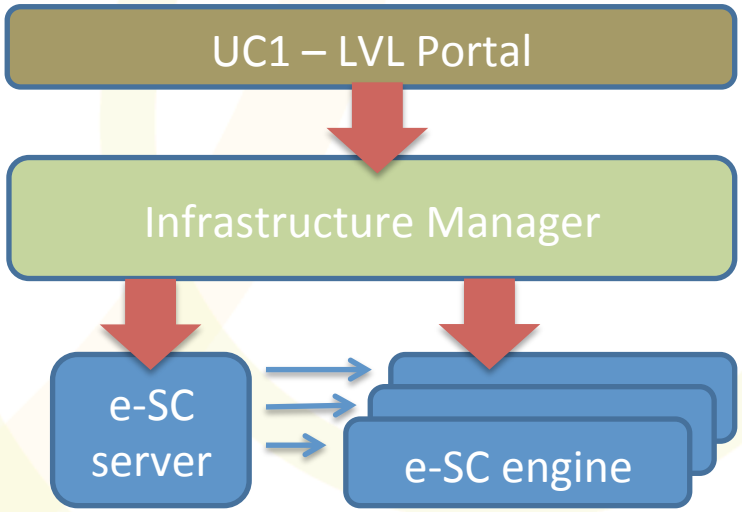
- **COMPSs**
  - Programming framework for automatic parallelization and orchestration of applications and services.
  - Elastic management of the resources depending on the load.
  - Transparent support of different infrastructures (grids, hybrid clouds, clusters).
  - Automatic selection of VM templates depending on the task.
  - **Adopted in the design of Heart Simulation use case.**



- **PMES**
  - OGF-BES service that allows the deployment and execution of COMPSs applications.
  - Contextualization of applications at deployment time.
  - Pre-allocation of static pool of VMs to save virtualization startup time.
  - **Dashboard for the management of applications.**
  - **Support to multiple providers.**

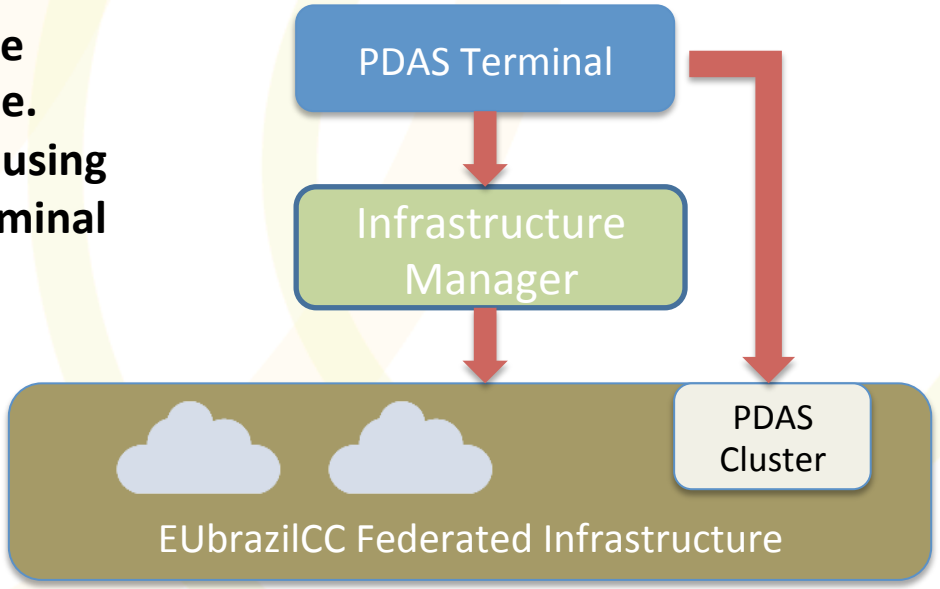
Programming Frameworks

- **eScience Central**
  - A cloud-based workflow management system that provides capabilities to store, analyse and share data.
  - Focused on the workflow developer, it provides a web UI to design and enact workflows, and code workflow blocks.
  - Built of two main components: the server and engine, connected with a task queue.
  - **Extensions to the API to facilitate sharing and execution of workflows as a consequence of the requirements identified in Leishmania Virtula Laboratory.**
  - **Integration with IM through RADL and Ansible scripts for automated system deployment.**
  - **The use of IM recipes facilitates configuring the worker instances for specific scenarios**

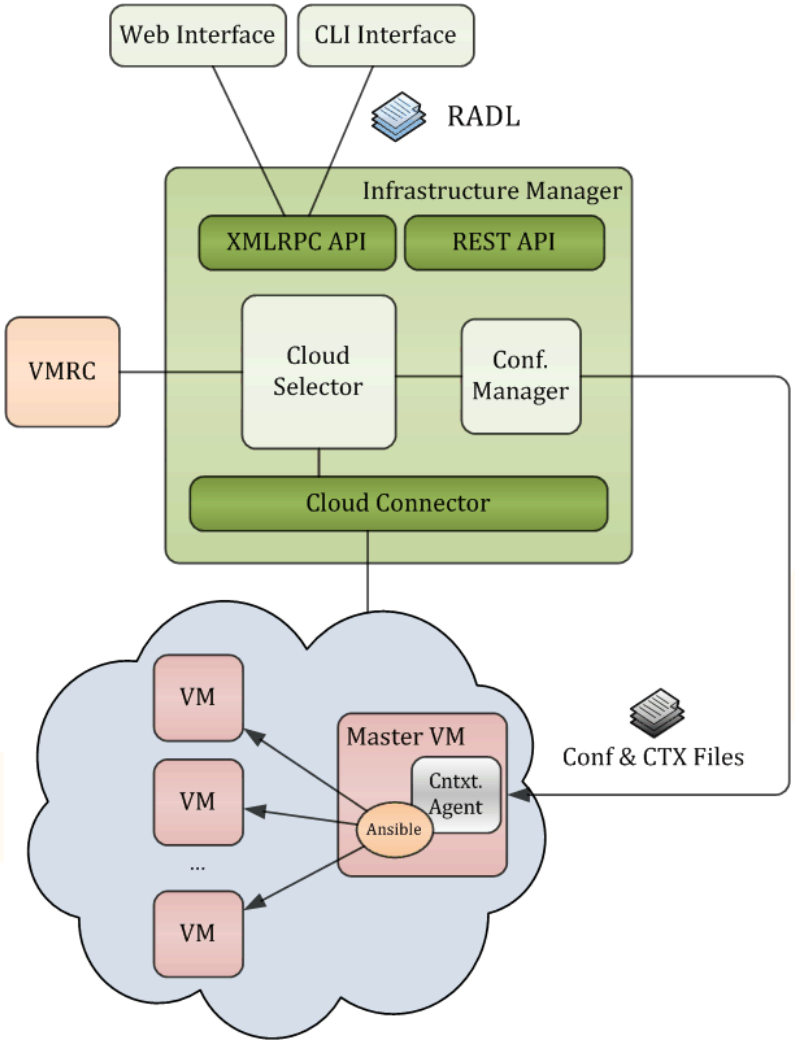


Programming Frameworks

- **PDAS**
  - Provide a parallel data analysis service for the management of large volumes of scientific multidimensional data
  - Extensions in terms of operators and primitives to support requirements identified in the Biodiversity and Climate change use case.
    - **New primitives/operators to fully address analytics requirements, heterogeneous data formats, performance.**
    - **Achieved KPI4.3 - Number of Scientific Data Analytics Functionalities (SDAF). Target: SDAF > 4 by the end of the first reporting period.**
  - **Support for different data formats (Landsat/Geotiff, CSV, LiDAR)**
  - **Interface GSI and VOMS**
  - **Client-side support: an official release of the PDAS terminal is now available.**
  - **Cloud deployment of a PDAS cluster using the IM service through the PDAS terminal**



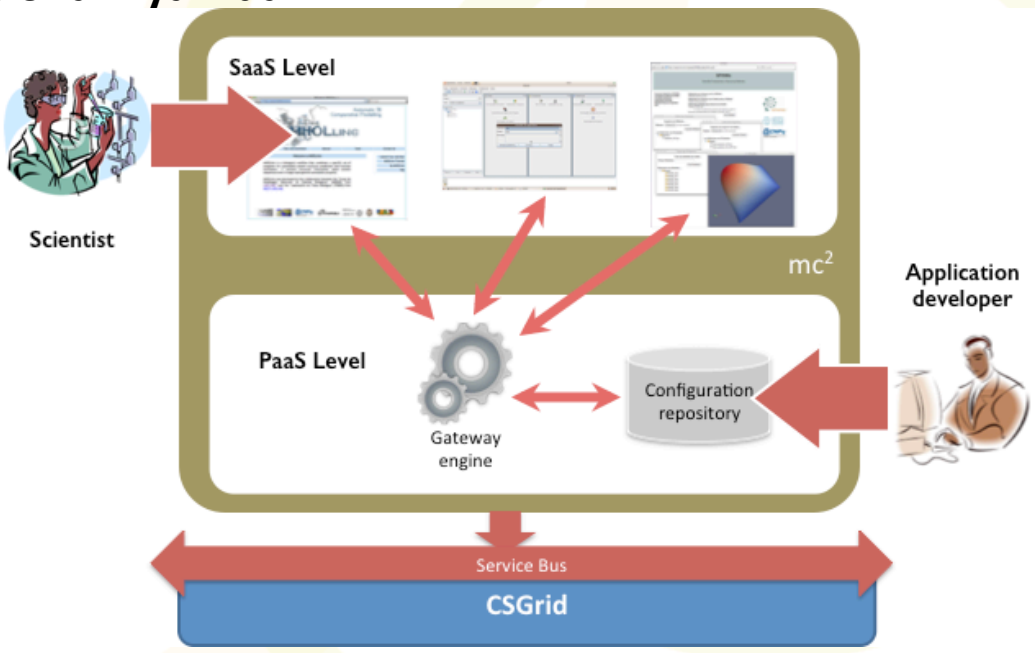
Execution and provisioning services



- **Infrastructure Manager (IM)**
  - Aims at facilitating the deployment of virtual infrastructures.
  - Supports OpenNebula, **OCCI (including fogbow)**, Amazon EC2, OpenStack, Azure, Google Cloud and libvirt
  - It can propagate X.509 credentials for the authentication on the on-premise cloud.
  - **Recipies for the eSC and PDAS have been developed.**
  - It supports the **EGI AppDB** and it is own Virtual Machine Resource Catalogue (VMRC).

User Interfaces to Scientific Gateways

- **mc2**
  - Built upon CSGrid services
    - Being ported to also give support to PMES-BES (as part of WP6)
  - Allows scientific application developers to rapidly implement and deploy new science gateways
  - **Included in the design of Heart Simulation Use Case to be used for configuring and submitting coupled simulations of a Alya-Adan**

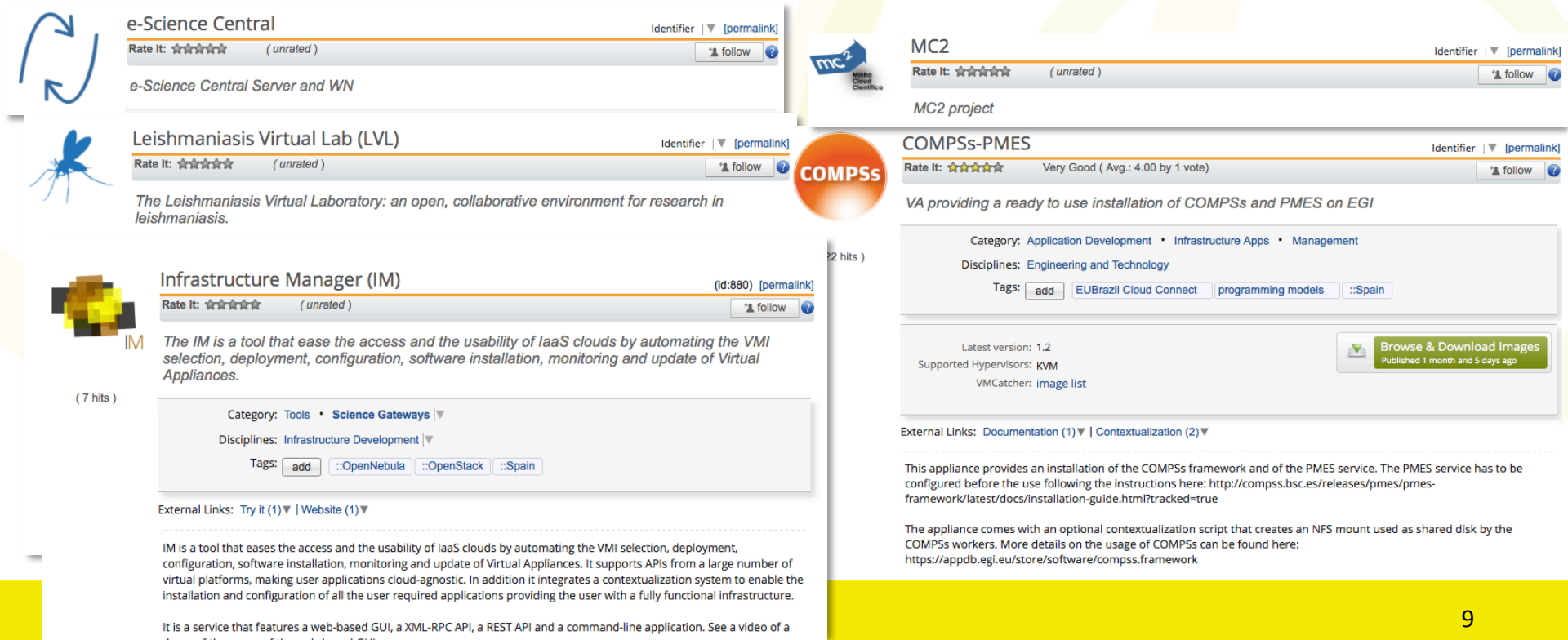


Interoperability

- **Build on previous experience of the partners**
  - VENUS-C Interoperability layer, EUBrazilOpenBio VREs
- **Adoption of standards and widely adopted protocols**
  - Following the EGI model: OCCI for IaaS management, CDMI for storage access, VOMS for resource level authorization management.
  - List of recommendations on the standards to be adopted available.
  - Specific study on formats for data exchange and for access to data sources in Europe & Brazil.
- **Assessment and validation of the software implementations**
  - Interoperability tests in collaboration with SDOs (Plugfests with OGF, SNIA).
  - Collaboration with eInfrastructures to share results (EGI).
- **Standards implementation plan**
  - Summarizes the implementation of each component of the infrastructure and provides a reference for standard adoption.

Interoperability

- **EGI: a succes story**
  - Compliance at IaaS level. Fogbow supports VOMS and provides OCCI interface, tested with EGI clients.
  - The aim of EUBrazilCC is to make software available in the AppDB through Virtual Appliances.
    - COMPSs and MC2 already available.
  - A *eubrazilcc.eu* VO has been created.
  - Plans to link Fogbow with the AppDB to retrieve the images.
  - COMPSs/PMES already adopted in EGI Fed Cloud use cases.
  - A mutual cross-benefit, enriching the application marketplace for both projects.



Interoperability

Standards implementation plan

Component	Interface	Implementation	Responsible	Details
OpenNebula	OCCI	rOCCI	Resource providers	http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/WP3_private_cloud_deployment_info
OpenStack	OCCI	OCCI-OS	Resource providers	http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/WP3_private_cloud_deployment_info
fogbow	OCCI	fOCCI	UFCG	http://www.fogbowcloud.org
	VOMS support	Done	UFCG	http://www.fogbowcloud.org
CSGrid	OCCI for job execution	fOCCI	PUC-Rio+UFCG	https://jira.tecgraf.puc-rio.br/confluence/display/CN/Download
IM	OCCI for VM deployment	rOCCI, OCCI-OS	UPV	http://www.grycap.upv.es/im/
	XML-RPC and REST APIs	Done		http://www.grycap.upv.es/im/
VMRC	OVF for image description		UPV	
COMPSs	OCCI for for VM management	rOCCI	BSC	http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs
PMES	BES for job management	VENUS-C BES	BSC	http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs#The-COMPSs-PMES
	OCCI for VM management	rOCCI client		
	CDMI for data management	VENUS-C CDMI		
e-SC	OCCI	To be implemented	UNEW	http://esciencecentral.co.uk
	TOSCA	To be implemented		
	REST API	Available		
PDAS	WS-I+	Done	CMCC	http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/PDAS
	REST API	To be implemented		
	GSI/VOMS support	Done		
	JSON for outputs representation	Done		
mc2	BES to interact with PMES	To be implemented	LNCC	

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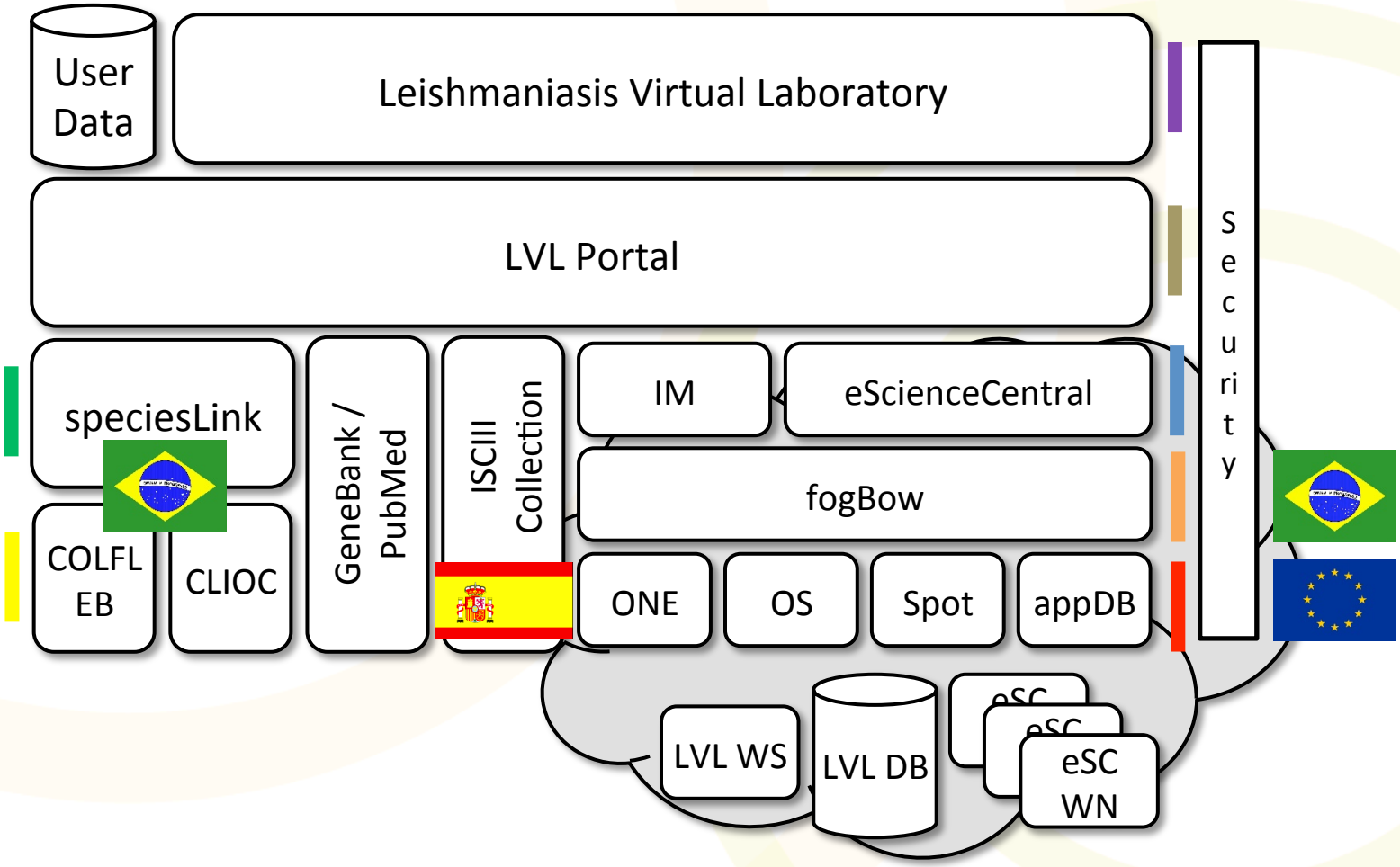
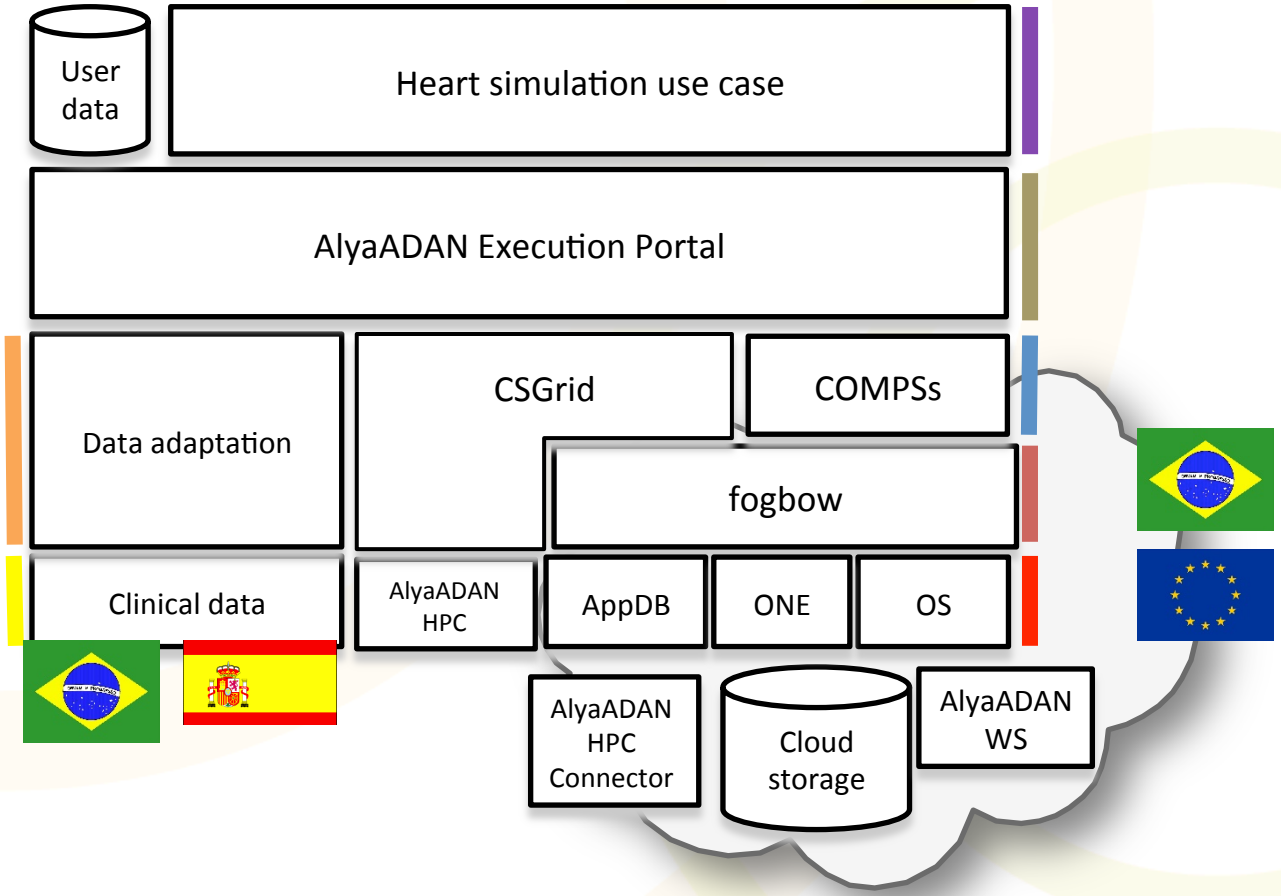
Use Cases requirements

	Leishmaniasis Virtual Laboratory	Cardiovascular System Simulation	Biodiversity and Climate Change
Goal	Data Integration and pipelines processing for studying the distribution of *Leishmania* parasites & vectors	Highly accurate simulation of vascular systems by integrating heart and arterial models	Data analysis for multiple climate indicators on historical and future data and forestry biomass
Need **EUBrazilCC**	Scalable set of VMs able to use cloud or cluster resources on demand	Separate simulators execution under strict coordination on heterogeneous infrastructures	Scalable data analytics tools on the cloud
Exploit	**eSC, IM, Fogbow**	**mc2, COMPSs, CSGRID, Fogbow**	**PDAS, IM, COMPSs and Fogbow**
Engage	Researchers, international organizations, pharmaceutical companies and public sector bodies	Cardiologists and researchers working on cardiovascular diseases	Research and education bodies, non-scientific users from the fields of forestry, earth science, biology, and environmental conservation

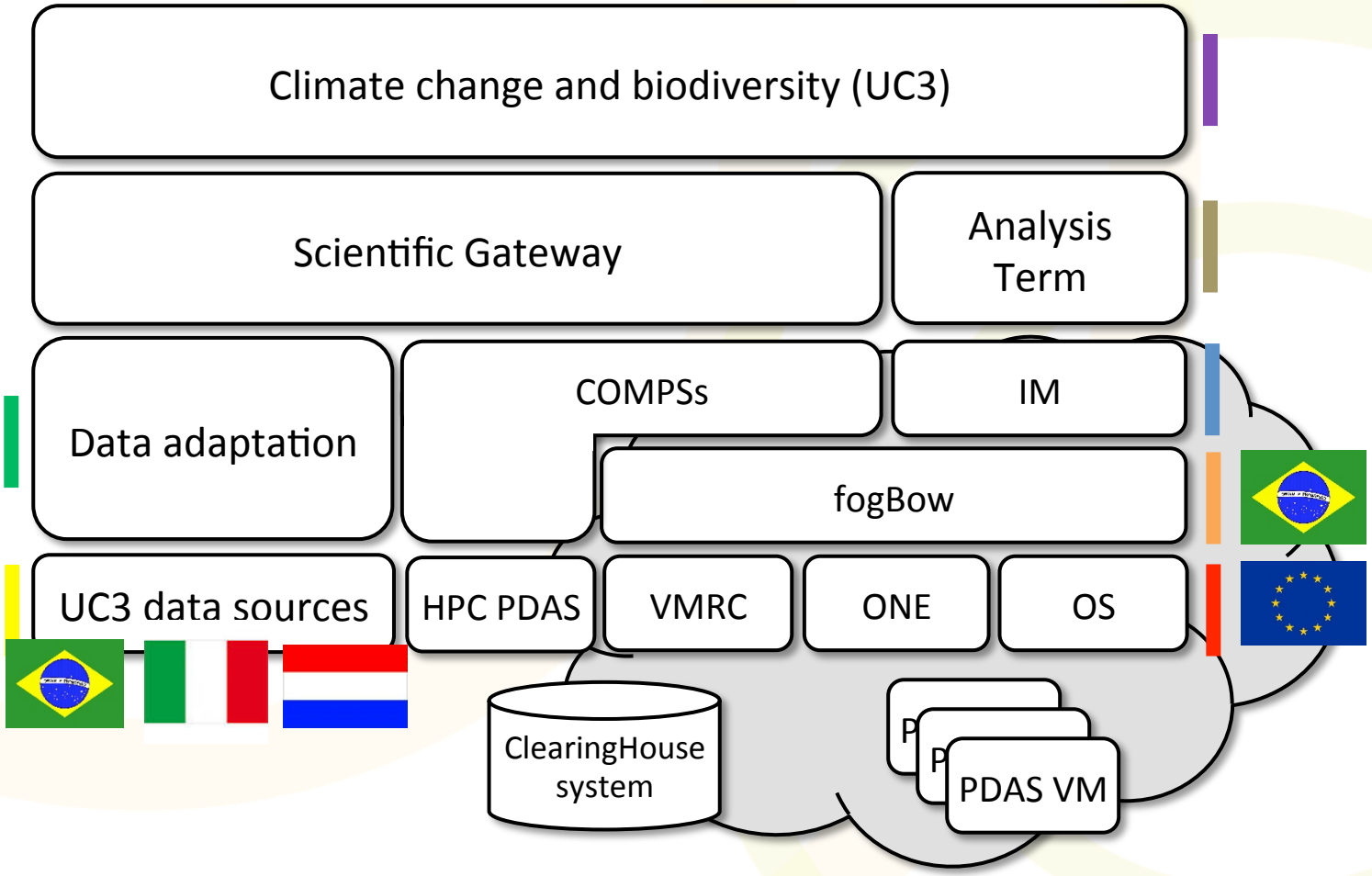
Implementation on EUBrazilCC



Implementation on EUBrazilCC



Implementation on EUBrazilCC



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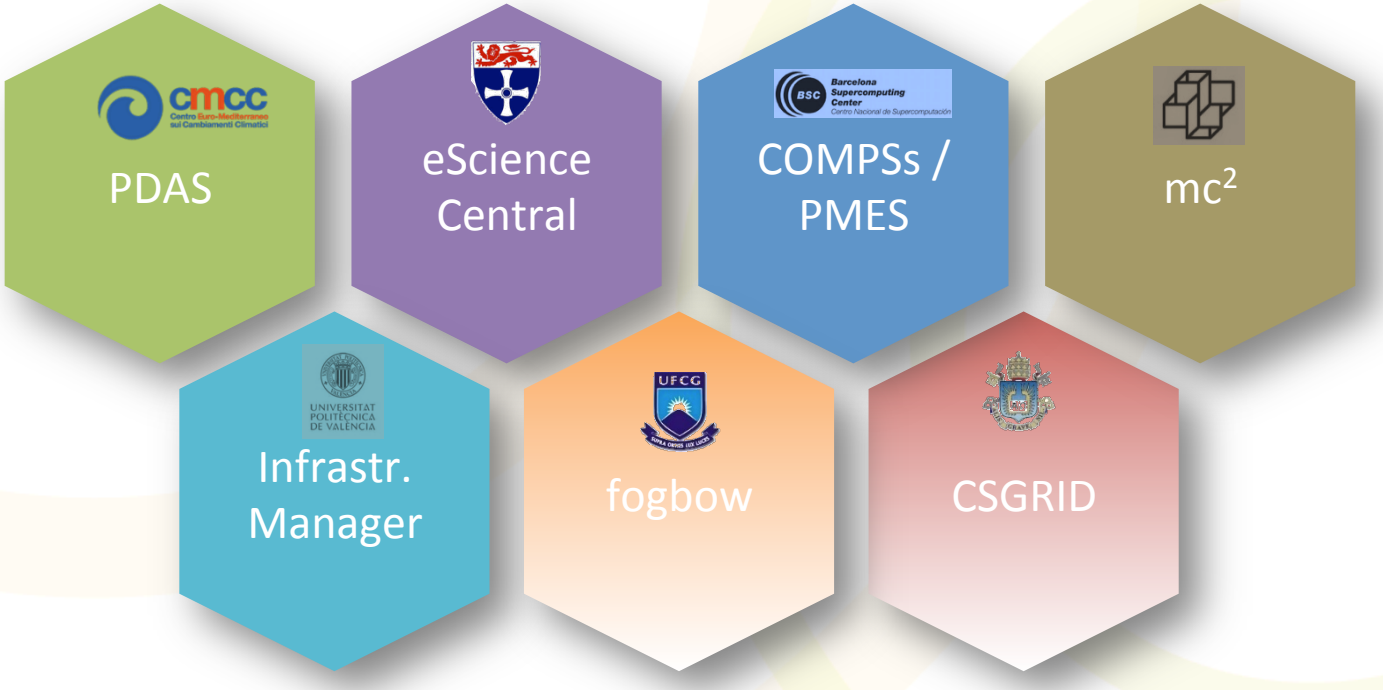
What have we done?
An integrated platform



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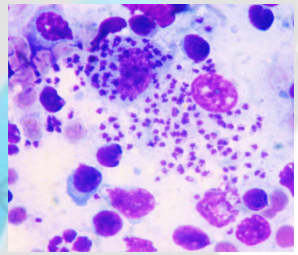

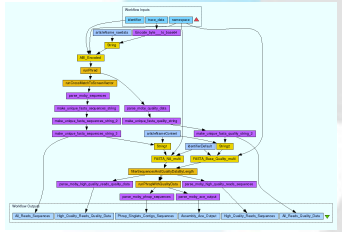

Federated Cloud
e-Infrastructure

Get ready for our applications!

Develop with our platform!

Federate with our middleware!

Thank you! Obrigado!

www.eubrazilcloudconnect.eu