Programming Frameworks

EGI Conference 2015
Daniele Lezzi (BSC)
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.
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.
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.
  - **Recipes 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.

The aim of EUBrazilCC is to make software available in the AppDB through Virtual Appliances.
## Standards implementation plan

<table>
<thead>
<tr>
<th>Component</th>
<th>Interface</th>
<th>Implementation</th>
<th>Responsible</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>OpenNebula</td>
<td>OCCI</td>
<td>rOCCI</td>
<td>Resource providers</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/1P3_private_cloud_deployment_info">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/1P3_private_cloud_deployment_info</a></td>
</tr>
<tr>
<td>OpenStack</td>
<td>OCCI</td>
<td>OCCI-OS</td>
<td>Resource providers</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/1P3_private_cloud_deployment_info">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/1P3_private_cloud_deployment_info</a></td>
</tr>
<tr>
<td>fogbow</td>
<td>OCCI</td>
<td>fOCCI</td>
<td>UFGG</td>
<td><a href="http://www.fogbowcloud.org">http://www.fogbowcloud.org</a></td>
</tr>
<tr>
<td>VOMS support</td>
<td>Done</td>
<td>UFGG</td>
<td></td>
<td><a href="http://www.fogbowcloud.org">http://www.fogbowcloud.org</a></td>
</tr>
<tr>
<td>CSGrid</td>
<td>OCCI for job execution</td>
<td>fOCCI</td>
<td>UFGG</td>
<td>PUC-Rio+UFGG</td>
</tr>
<tr>
<td></td>
<td>rOCCI, OCCI-OS</td>
<td></td>
<td>UPV</td>
<td><a href="http://www.grycap.upv.es/im/">http://www.grycap.upv.es/im/</a></td>
</tr>
<tr>
<td>IM</td>
<td>XML-RPC and REST APIs</td>
<td>Done</td>
<td>UPV</td>
<td><a href="http://www.grycap.upv.es/im/">http://www.grycap.upv.es/im/</a></td>
</tr>
<tr>
<td>VMRC</td>
<td>DVF for image description</td>
<td></td>
<td>UPV</td>
<td></td>
</tr>
<tr>
<td>COMPSs</td>
<td>OCCI for for VM management</td>
<td>rOCCI</td>
<td>BSC</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs</a></td>
</tr>
<tr>
<td>PMES</td>
<td>BES for job management</td>
<td>VENUS-C BES</td>
<td>BSC</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs-PMES">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs-PMES</a></td>
</tr>
<tr>
<td></td>
<td>OCCI for VM management</td>
<td>rOCCI client</td>
<td>BSC</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs-PMES">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs-PMES</a></td>
</tr>
<tr>
<td></td>
<td>CDMI for data management</td>
<td>VENUS-C CDMI</td>
<td>BSC</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs-PMES">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/COMPSs-PMES</a></td>
</tr>
<tr>
<td>e-SC</td>
<td>OCCI</td>
<td>To be implemented</td>
<td>UNEW</td>
<td><a href="http://esiencecentral.co.uk">http://esiencecentral.co.uk</a></td>
</tr>
<tr>
<td></td>
<td>TOSCA</td>
<td>To be implemented</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>REST API</td>
<td>Available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDAS</td>
<td>WS-IF</td>
<td>Done</td>
<td>CMCC</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/PDAS">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/PDAS</a></td>
</tr>
<tr>
<td></td>
<td>REST API</td>
<td>To be implemented</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GSI/VOMS support</td>
<td>Done</td>
<td>CMCC</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/PDAS">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/PDAS</a></td>
</tr>
<tr>
<td></td>
<td>JSON for outputs representation</td>
<td>Done</td>
<td>CMCC</td>
<td><a href="http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/PDAS">http://eubrazilcc-rm.i3m.upv.es/projects/eubrazilcc/wiki/PDAS</a></td>
</tr>
<tr>
<td>mc2</td>
<td>BES to interact with PMES</td>
<td>To be implemented</td>
<td>LNCC</td>
<td></td>
</tr>
</tbody>
</table>
# Use Cases requirements

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

Climate change and biodiversity (UC3)

Scientific Gateway

Data adaptation

UC3 data sources

Climate change and biodiversity (UC3)

Analysis Term

HPC PDAS

VMRC

ONE

OS

COMPSs

IM

fogBow

PDAS VM

ClearingHouse system
What have we done?
An integrated platform
Get ready for our applications!

Develop with our platform!

Federate with our middleware!

Thank you! Obrigado!

www.eubrazilcloudconnect.eu