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Orchestration of Applications on Multiple Clouds with COMPSs

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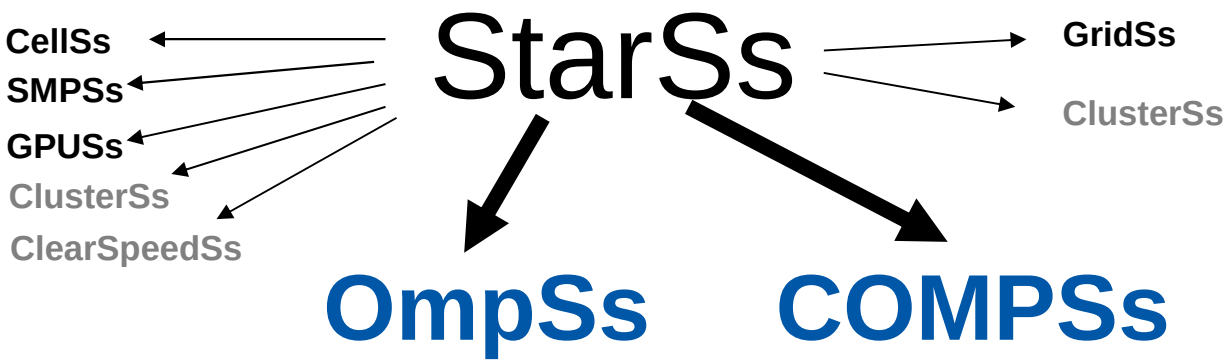
Outline

- Overview of COMPSs/ServiceSs
- Overview of interoperability approaches with COMPSs/ServiceSs
- Interoperability to cloud middleware through connectors
- Use cases & projects

The StarSs programming model



- StarSs
  - Sequential C/Fortran/Java + annotations
  - Task based
  - Simple linear address space
  - Support for SMP, GPUs, Cluster, Grids and Clouds

Open Source
http://compss.sourceforge.net

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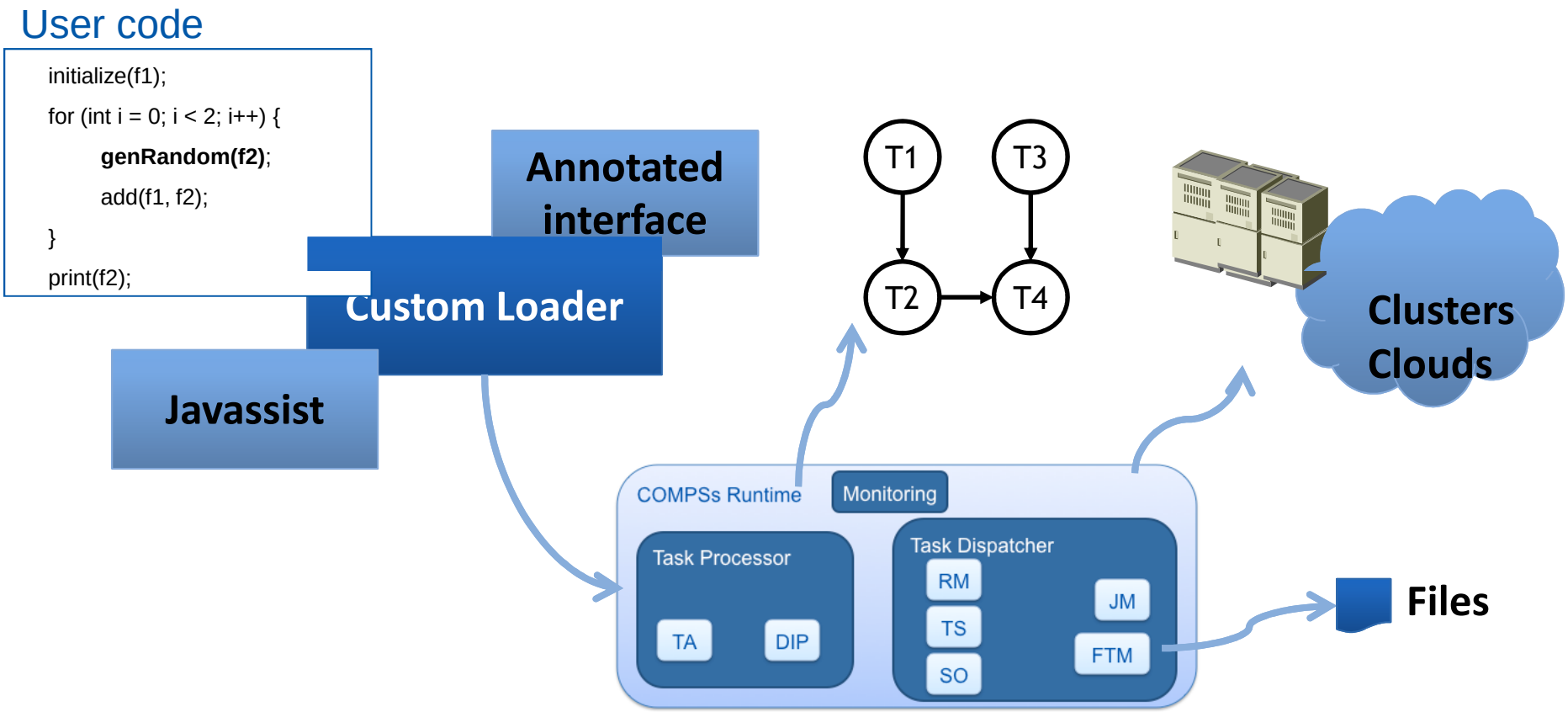
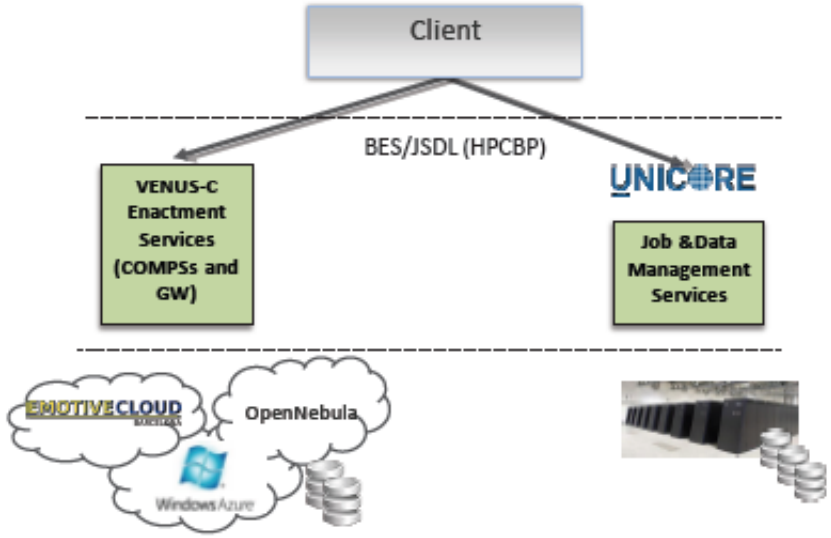
- Programmability/Portability
  - "Same" source code runs on "any" machine
  - Incremental parallelization/restructure
  - Focus in the problem, not in the hardware
- Performance
  - Intelligent Runtime
    - Automatically extracts and exploits parallelism
    - Locality awareness
    - Matches computations to specific resources on each type of target platform

COMPSs Infrastructure



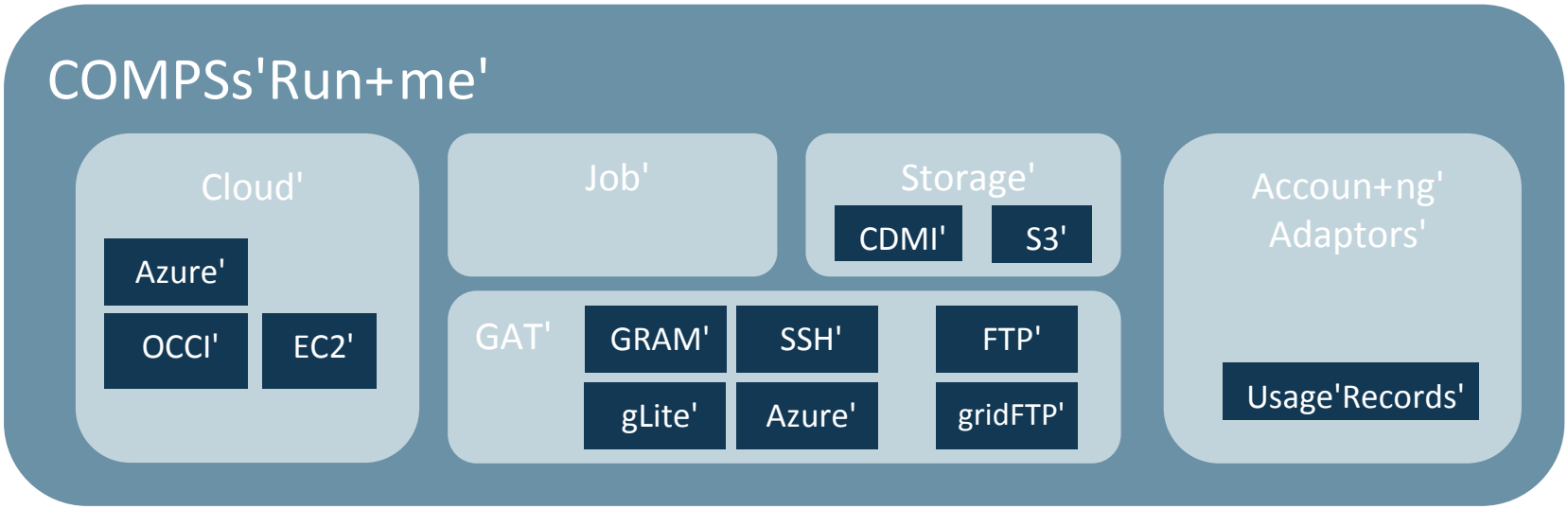
Overview of interoperability approaches with COMPSs/ServiceSs

- Interoperability through web services: ServiceSs
  - "Tasks" in ServiceSs can be WS
  - Whole applications can be exposed as WS
- Interoperability through high-level standards
  - Venus C execution platform implements OGSA-BE standard
  - Enables transparent execution of applications



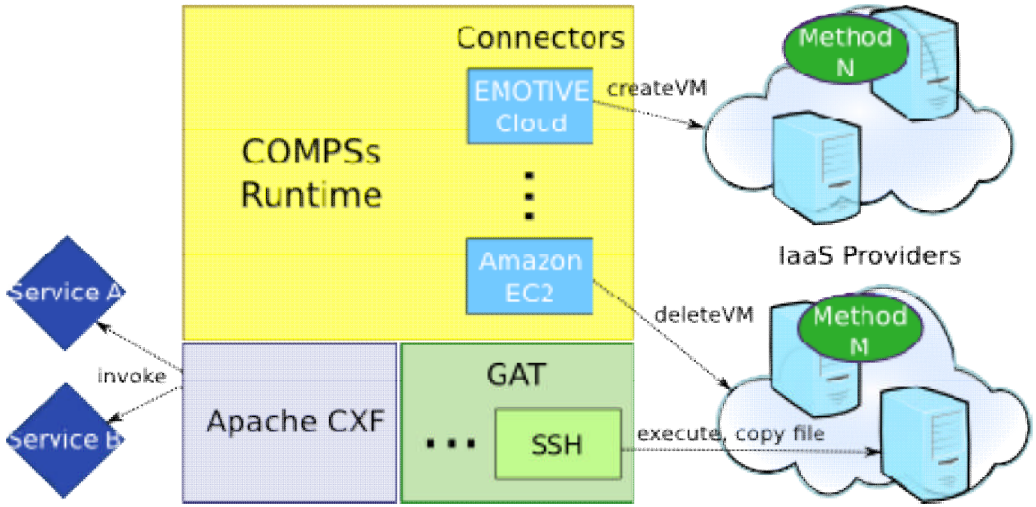
- Interoperability to cloud middleware through connectors

Introduction to COMPSs



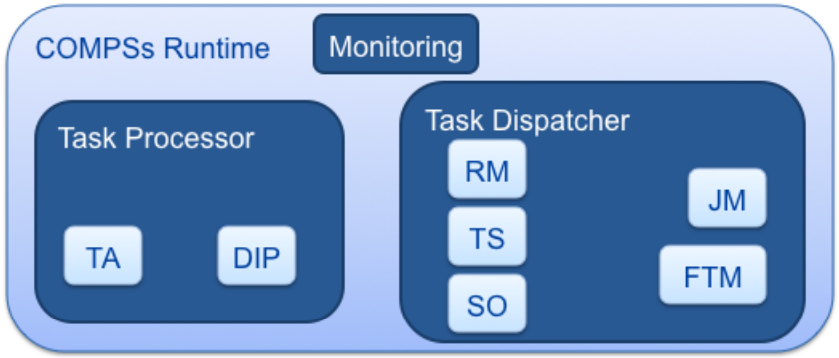
Interoperability to cloud middleware through connectors

- The runtime communicates with the Cloud by means of Cloud connectors
- The connectors implement the interaction of the runtime with a given Cloud provider
- Connectors abstract the runtime from the particular API of each provider
- This design facilitates the addition of new connectors for other providers.



Middleware interoperability in COMPSs

- Task Scheduler
  - Assigns tasks to VMs or physical resources
  - Each VM or resource has its own task queue
- Scheduling Optimizer
  - Checks status of workers
  - Can decide
    - To perform load balancing
    - Create/destroy new VMs
- Resource Manager
  - Manages all cloud middleware related features
  - Holds information about all workers and about cloud providers
  - Scheduler Optimizer sends to the RM requirements about new VM characteristics
    - i.e., VM that can run 3 tasks of type T1 and 2 tasks of type T2
  - Resource Manager, evaluates the cloud providers and chooses the best option
    - More economic
    - The decision can be to open a new private or public VM
  - For each Cloud provider, a data structure stores the different available instances (with its features) and the connector that should be used



Middleware interoperability in COMPSs

- Cloud Connector
  - Interface that enables
    - Create VM
    - Destroy VM
    - Cost?
    - Time to create?
  - When we want to add a new Cloud Provider, we just need to implement this interface
    - A special case is an implementation that supports the OCCI standard
  - Two type of threads in the Connector
    - Creation thread
      - To create and contextualize a VM
    - Deletion thread
      - To destroy a machine
      - Before destroying the VM, TS waits until all tasks assigned finish and FTM moves remaining files to the master

OPTIMIS

The cloud's silver lining

Facilitating Cloud Deployment

OPTIMIS Programming Model and IDE allow developers to focus on business logic not worrying on implementation Cloud issues. OPTIMIS takes care of creating a Service Manifest and all Images required for deployment

Multi-Cloud Broker

OPTIMIS Cloud Broker includes capabilities that enable multi-cloud deployment supported with enhanced security provisioning including VPN Overlay Intelligent Protection System and Secure Storage for each of the services deployed through the Cloud Broker

Optimis

Optimizing the full Cloud Lifecycle

OPTIMIS Toolkit optimizes full service lifecycle from development, deployment and operation taking trust, risk, eco-efficiency, cost and legal issues into account.

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optimis-project.eu

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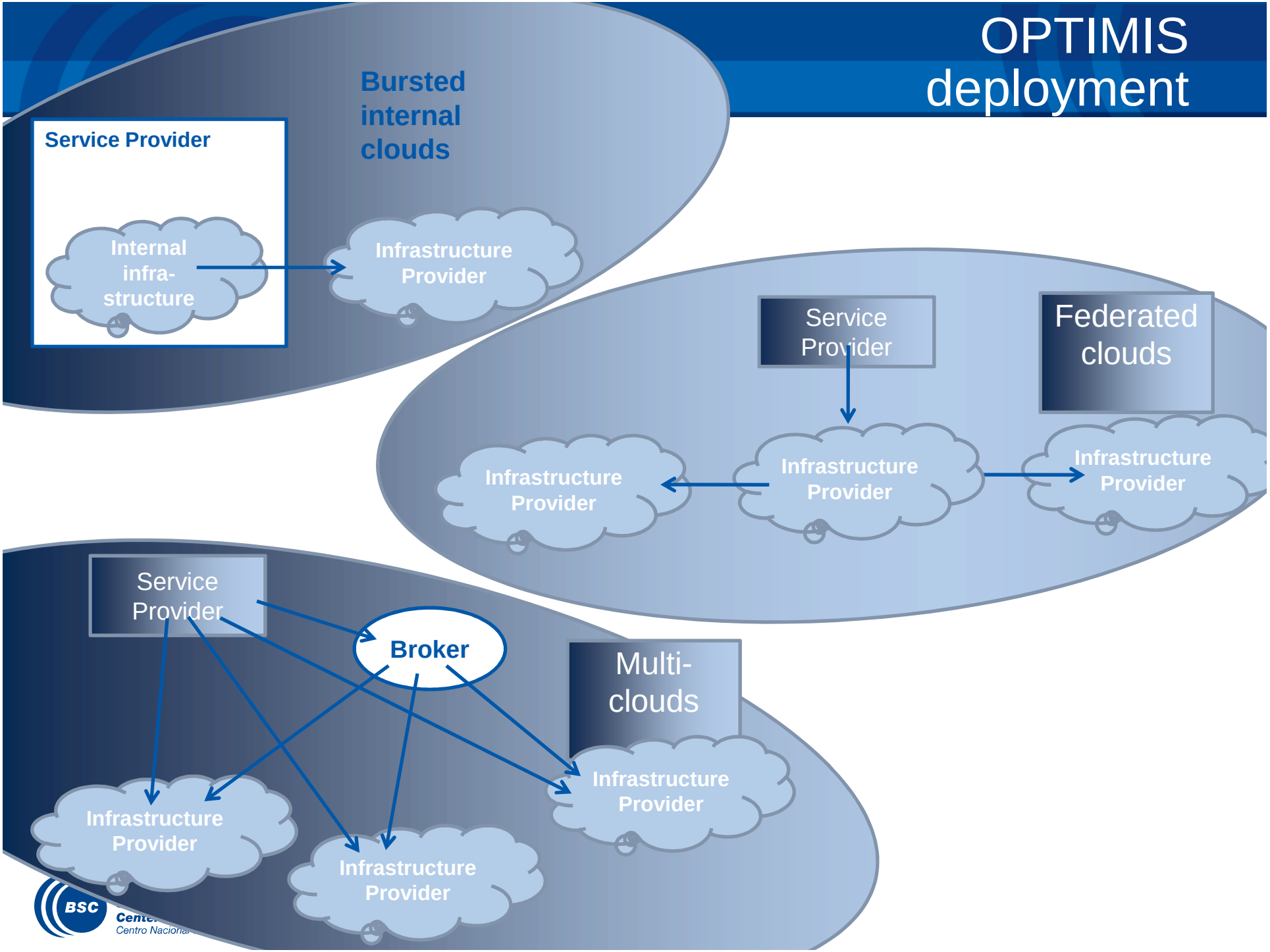
@optimisfp7

SEVENTH FRAMEWORK PROGRAMME

Optimis is a "software infrastructure-as-a-service" offering that enables organizations to automatically externalize services and applications to best execution venues in the hybrid cloud model

Atos · BSC · SAP · University of Leeds · flexiant · Arsys · HLRS · Umeå University · Fraunhofer · the 451 group · BT · City University London

OPTIMIS deployment

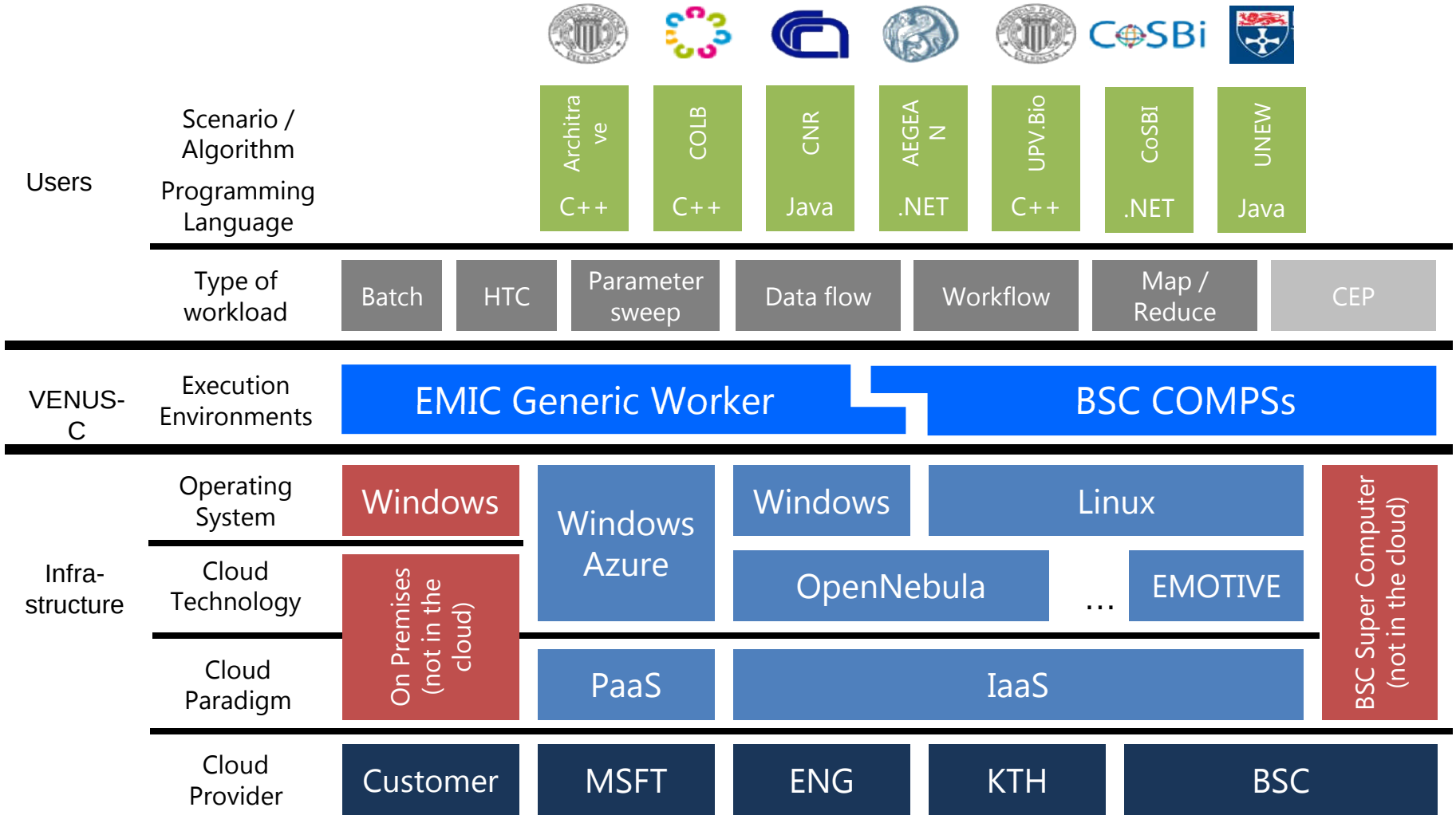


The VENUS-C Platform

- Goal: “Create a sustainable infrastructure that enables user applications to leverage cloud computing principles”
- Funded by European Commission as FP7 Research Infrastructures Projects
- Interactive web and training channel: http://www.venus-c.eu/

- e-Science as a Service
  - 7 Scenarios
  - 15 Open-Call Pilots
  - 5 Open-Call Experiments
- June ‘10 - May ‘12 (support until May ‘13)
- Free of charge access to Azure

The VENUS-C Platform



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EU-BrazilOpenBio

EU-Brazil Open Data and Cloud Computing e-Infrastructure for Biodiversity

Combining ***Biodiversity Science*** and the ***Open Access Movement to deploy*** ***a joint European and Brazilian e-Infrastructure*** of ***open access resources*** supporting ***the needs of the biodiversity scientific community***.

Two biodiversity use cases

Computing resources & SW platforms

Further **EU-Brazil collaboration** in support of the **biodiversity area & infrastructures**

Who will benefit from EUBrazilOpenBio?

- **EU & Brazilian biodiversity scientific communities**
- **Data and resource managers & Open Access community**
- **European & Brazilian policy and funding bodies**

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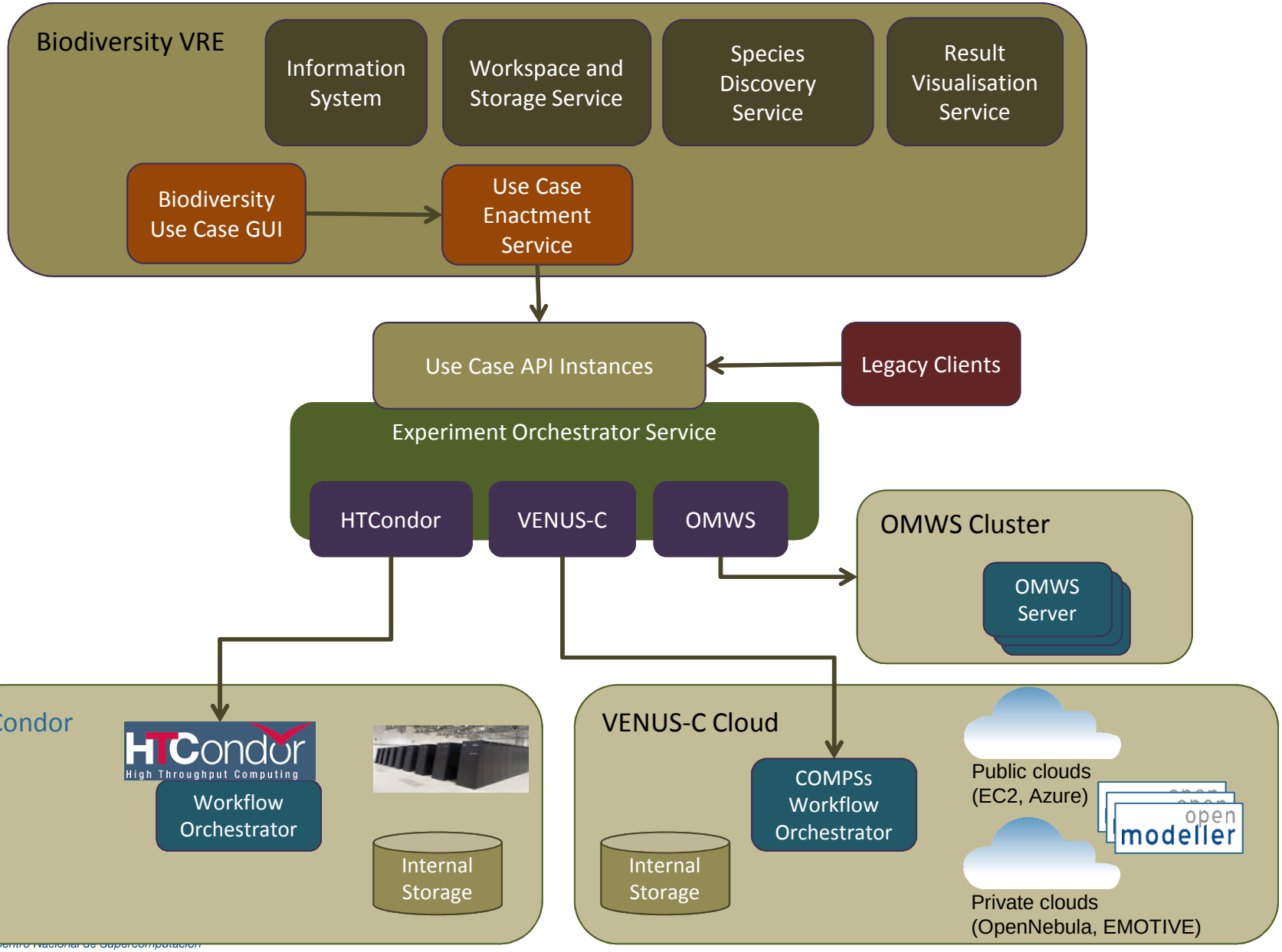
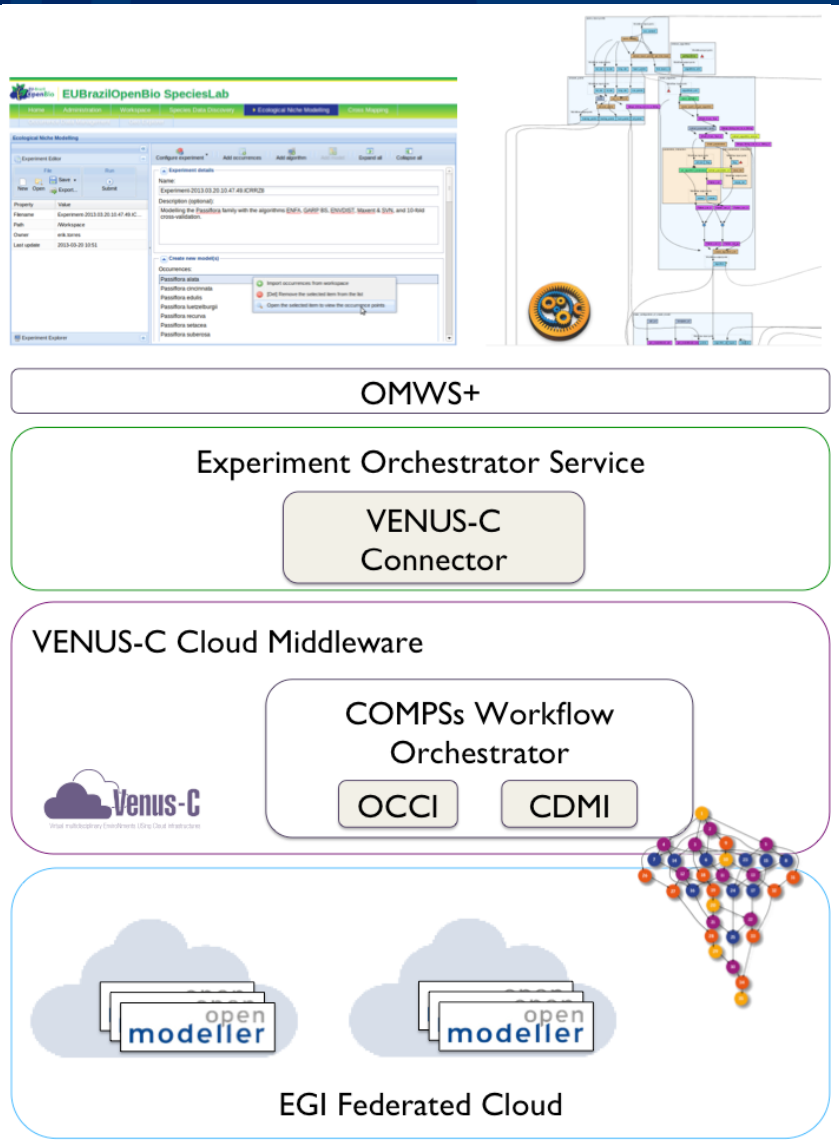
EU-BrazilOpenBio

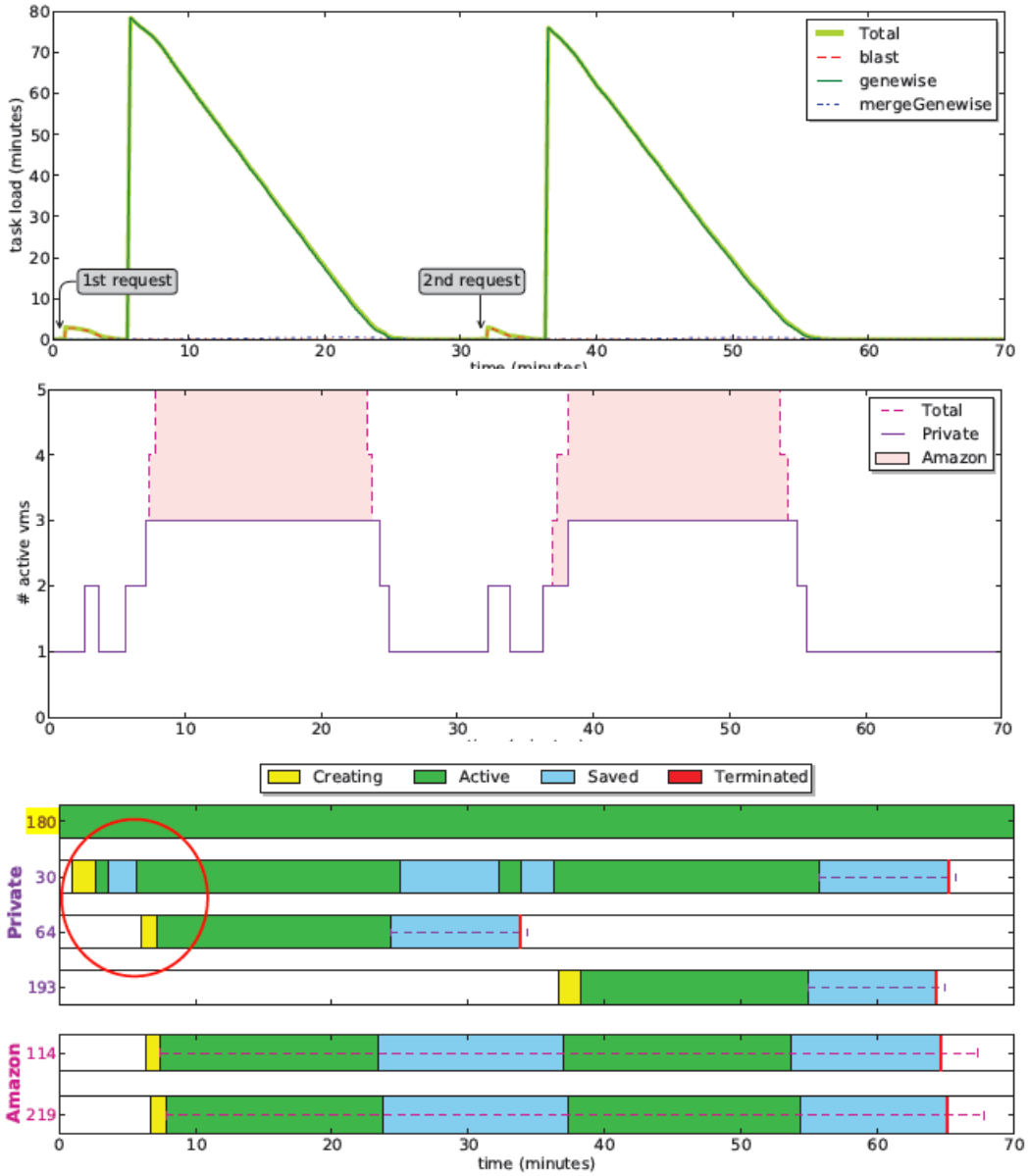


Interoperable execution of workflows in EGI Cloud

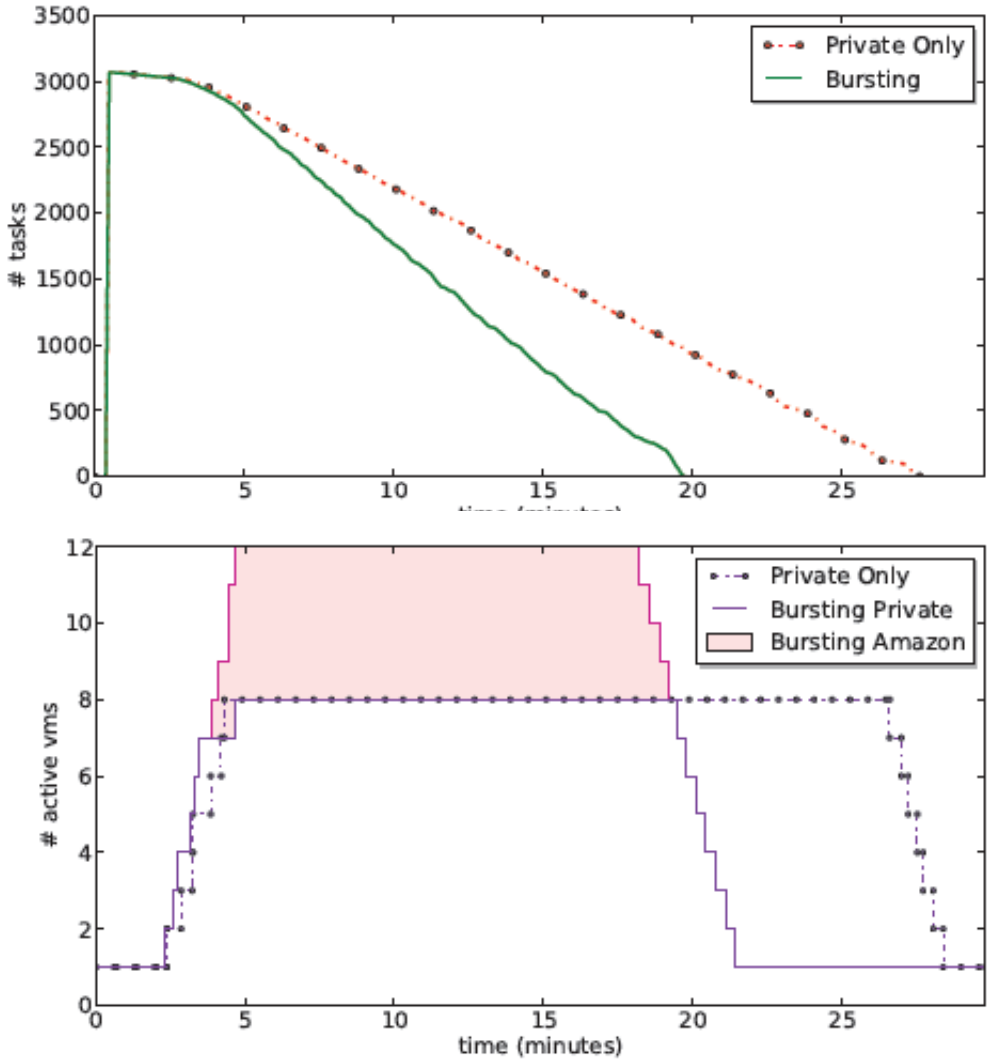


- EGI Federated Cloud: interoperable integration of virtualised resources from different resource providers to provide an integrated federated virtualised resources infrastructure for exploitation by EGI's user community.
- Interoperability based on standards
- Different communities same architecture.
- COMPSs enables the execution of Taverna workflows thanks to interoperability features

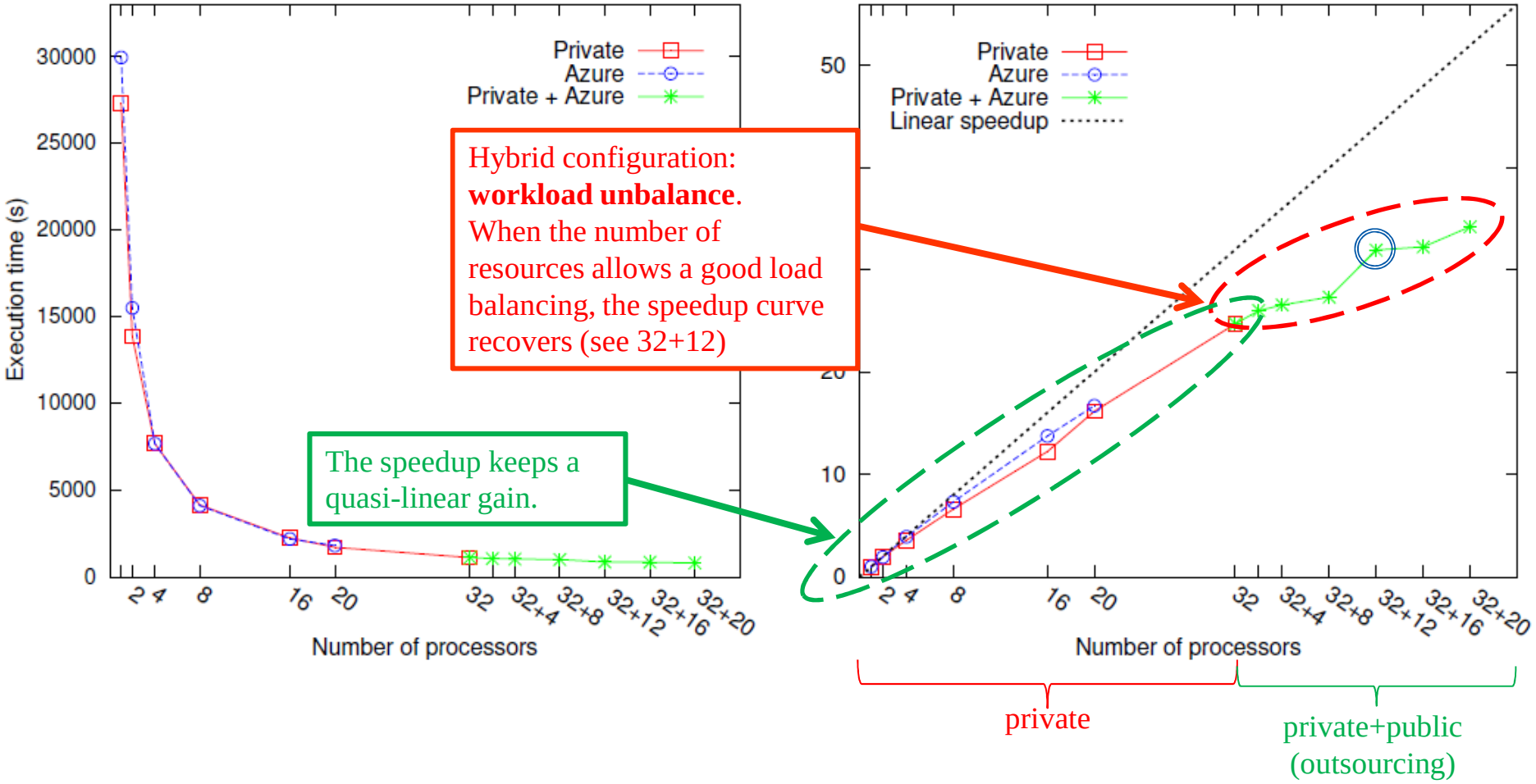
Evaluation: Elasticity and Bursting



Evaluation: Performance and Scalability



Evaluation: Performance



- Execution time (a) and speedup (b) values depending on the number of processors

Conclusions

- COMPSs/ServiceSs abstract application developers from the underlying infrastructure
- Provides a PaaS interoperable with different Cloud providers
- ServiceSs applications can be offered as SaaS
- Interoperability offered at different levels

Thanks for your attention

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