GaaS: toward a more “elastic” and sustainable grid environment

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Grid vs Cloud paradigms

- Grid Computing enables the **sharing** of **huge** amount of resources with:
  - a well-defined **distributed** infrastructure model
  - an unified interface for **jobs and data management**
  - a **static** resources aggregation model

- Cloud Computing provides **flexibility** and **cost reduction**: by means of:
  - resources **dynamically** acquired on demand
  - **enlargement** and **shrinking** of the infrastructure
  - a "**general purpose**" interface

Typical Grid usage model

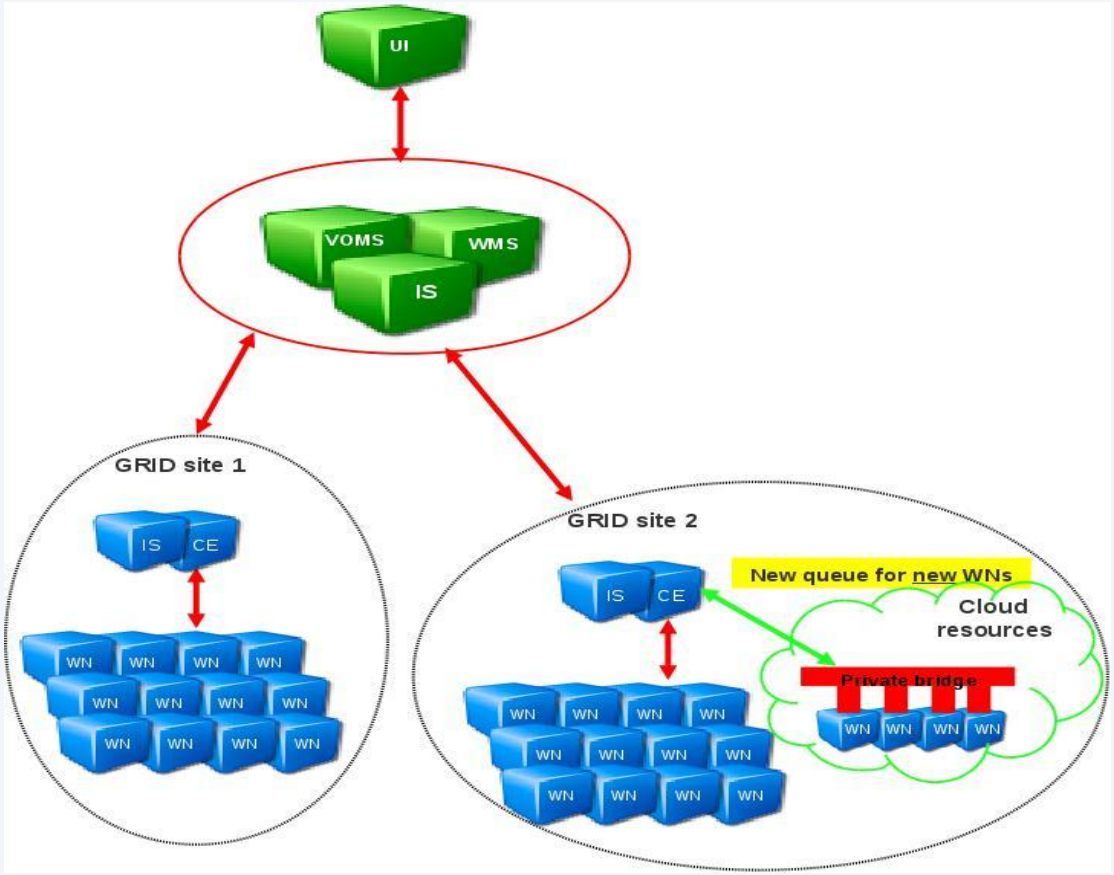
- Users cannot change, on demand, the Grid Infrastructure that runs their experiments. In particular they cannot:
  - add new worker nodes to a site to extend its computing capabilities
  - organize resources into customized queues to shape them in accordance to the computation needs
  - change worker nodes configuration
  - …
- To solve this issue we propose **GaaS**

The GaaS solution

- GaaS model can be classified as a **Platform-as-a-Service,** combining Cloud Computing flexibility with Grid's interface

- GaaS aims to extend Grid environments on demand with elastic (virtual and physical) resources:
  1. new standard WNs;
  2. new queues or new queue policies configuration;
  3. new Grid Sites;
  4. new tailored WNs;
- GaaS consists in four services

GaaS_WNS (Worker Node Service)



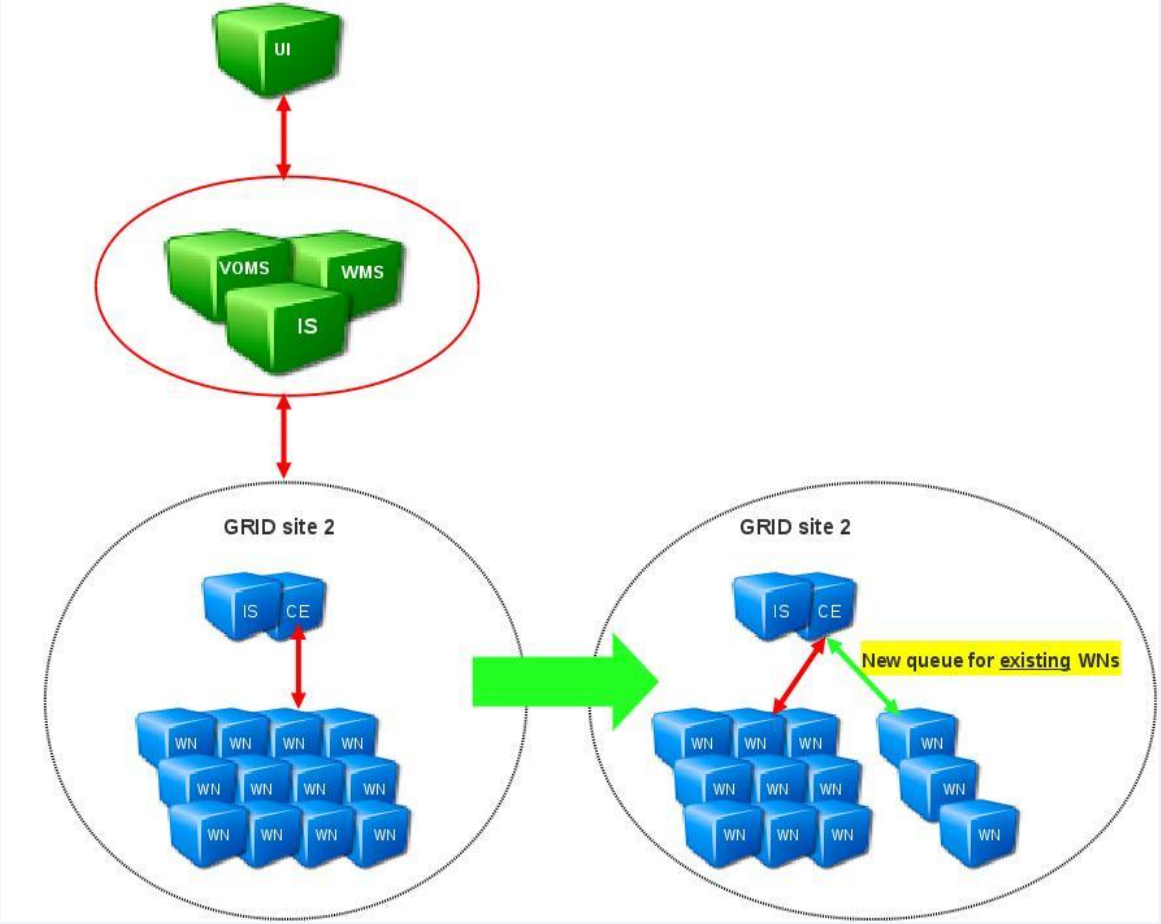
Service description

definition, addition and deletion of WN to be used by the Grid infrastructure

Possible use cases

realization of efficient datacenters management in term of energy consumption reduction

GaaS_QS (Queue Service)



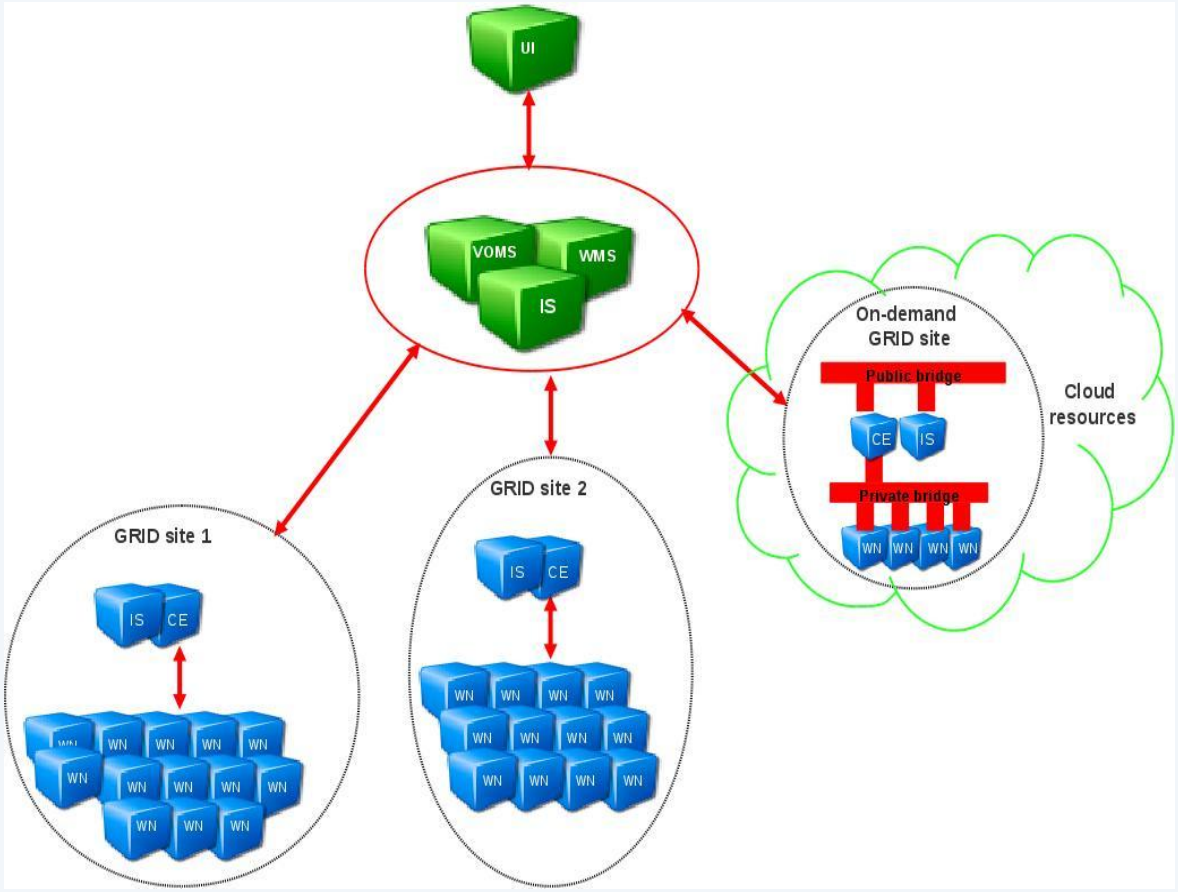
Service description

aggregation of existing computing resources in a new queue with different policies

Possible use cases

deployment of particular queue policies (i.e. queue priority for the community users, different values for max walltime of execution, etc.)

GaaS_GSS (Grid Site Service)



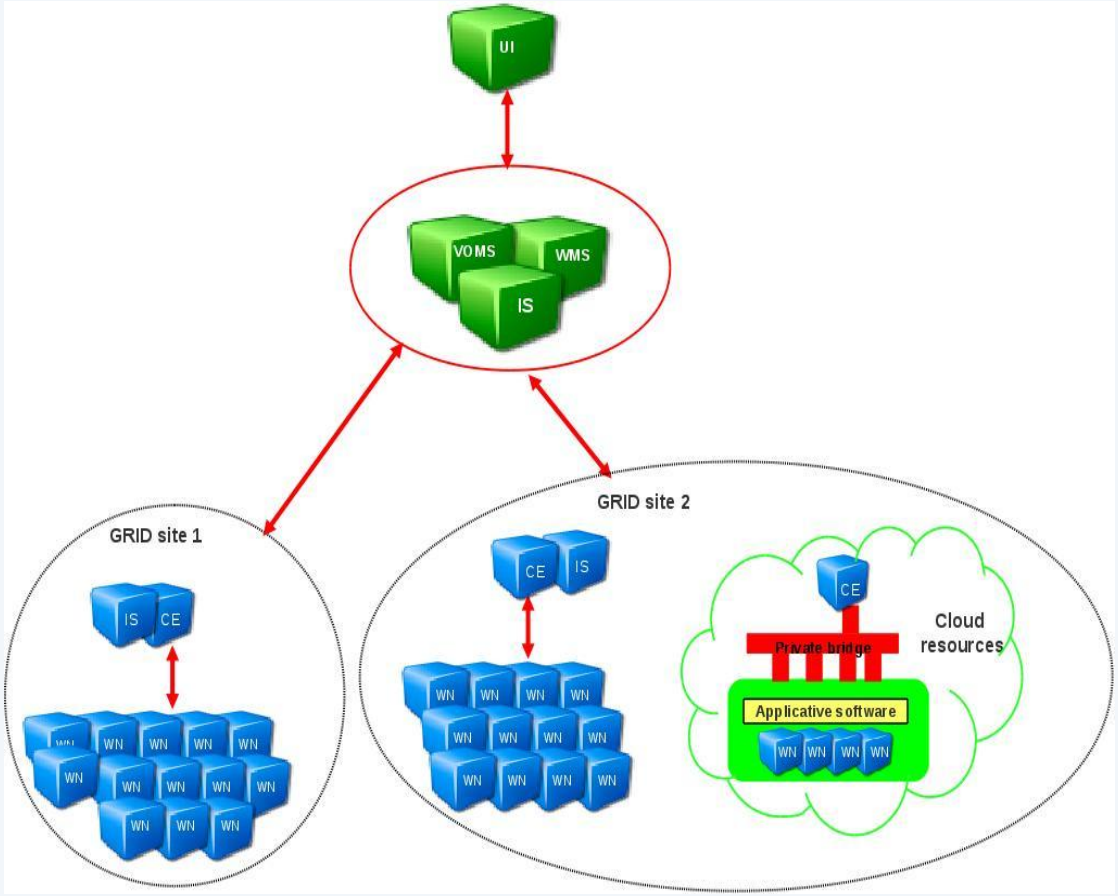
Service description

creation and management of new Grid Sites for an existing VO

Possible use cases

sharing of resources with a community for the life time of a project, to avoid the burden of configuring from scratch all the required services and resources

GaaS_AES
(Applicative Environment Service)



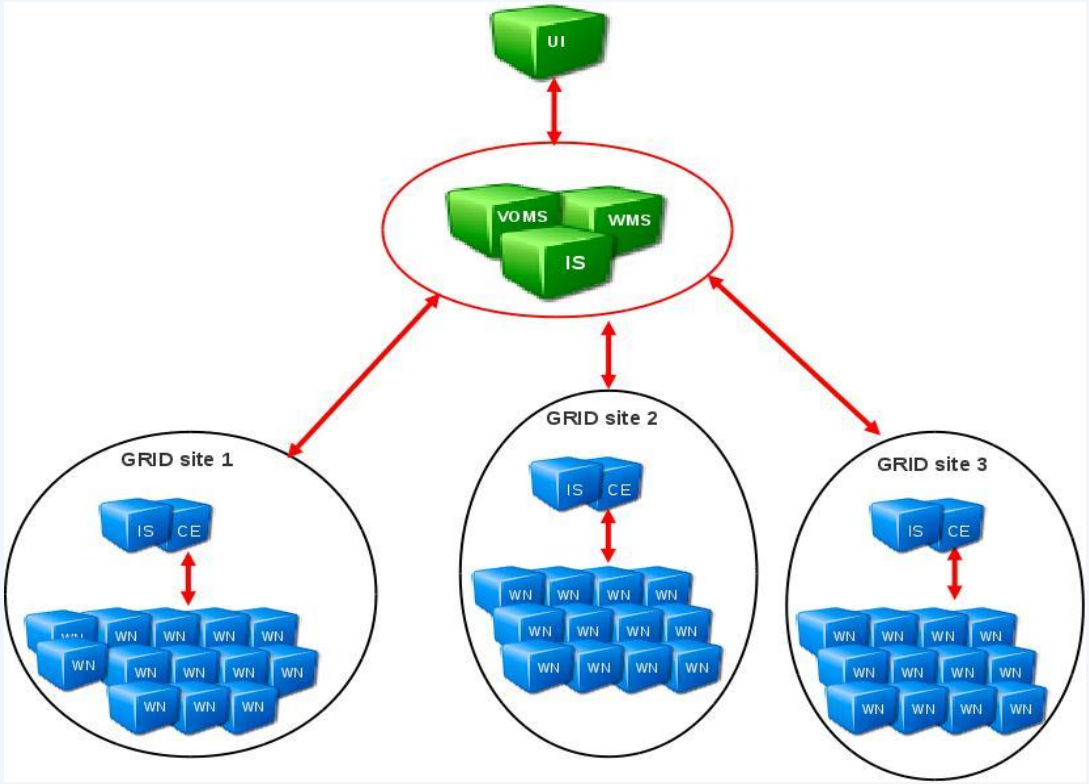
Service description

creation of a suited runtime environment for a set of applications on existing or new computing resources

Possible use cases

giving the chance to a community to run an application in a proper software enviroment (proper applicative middleware)

The S.Co.P.E. grid reference architecture



- **UI**: User Interface
- **VOMS**: VO management system
- **WMS**: Workload management system
- **IS**: Infrastructure Service
- **CE**: Computing Element
- **WN**: Worker Node

The S.Co.P.E. User Community

- Belonging to different disciplines in the field of Engineering, Chemistry, Applied Mathematics, Physics, …
  - requires a large set of very different optimized scientific software tools (libraries, compilers, PSE, applicative , …)
  - needs different kind of resources

The GaaS prototype

- Implemented in the context of the **S.Co.P.E**. datacenter, Integrated into national **IGI** and international **EGI** distributed computational infrastructures
- Based on:
  - **gLite-EMI** Grid Middleware
  - **OpenNebula** cloud management system
  - **Xen** Hypervisor

GaaS prototype characteristics

- The main efforts in the prototype development were
  - the definition of templates for gLite-EMI services configuration,
  - the enabling of their fast provisioning.

- Focus on deployment strategies:
  - we use on all VMs the operating system imposed by the gLite-EMI middleware;
  - all the VMs hosting the Grid services (e.g., WN, CE, etc.) can be produced by customizing the configuration of a single VM template
  - we use of some at Operating System features (e.g LVM snapshots)

Conclusions and future works

- The presented work is a successful proof-of-concept but many issues still have to be solved.

- At present we are also using GaaS prototype to provide solutions aimed to an environmentally conscious use of datacenters (e.g. by means of services able to stop and start dinamically hardware resources on the basis of real system load, …)
- We are working on solutions able to allow new communities wishing to use the grid to instantiate new grid infrastructure also for the non existing VOs

Some remarks

- GaaS doesn't aim to be a final product, not yet. In future, if provided with a simple GUI, GaaS could be put in production some particular use cases.

- It has been developed as a prototype to:
  - verify and compare some Cloud/Grid integration techniques
  - validate the deployment of some hybrid services
  - stimulate a more conscious use of resources by user communities

Thanks for the attention

Questions