Business applications: the COMETA approach

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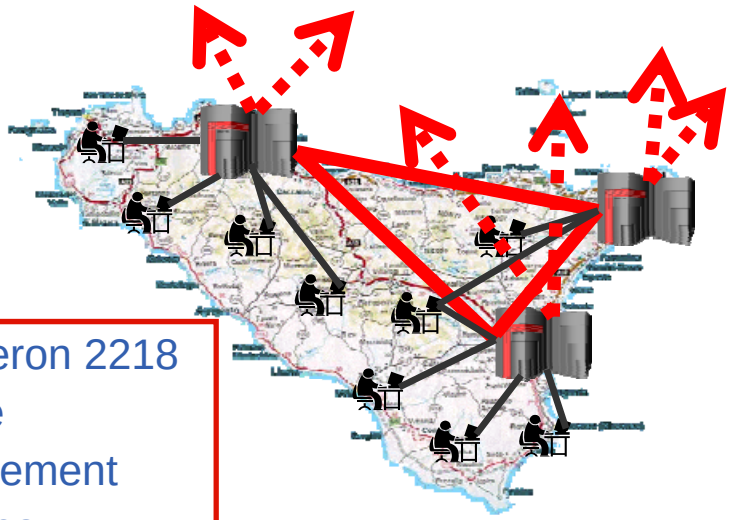
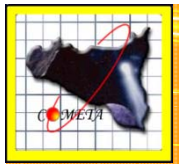
The COMETA Consortium

- **Creation of the first Sicilian GRID infrastructure for scientific and industrial applications (Overall budget 15 M€)**
- **Integration with the Italian and European GRIDs to foster and improve the scientific collaboration and the competitiveness of regional PMI, both at national and international level**
- **Porting of scientific and industrial applications on the GRID**
- **Dissemination of the "GRID paradigm" through events and training courses to people of the private and public area, also not directly involved in such projects**
- **Support to spin-off initiatives**



~2000 core AMD Opteron 2218
2 GB di RAM per core
LSF for queue management
Infiniband-4X in all sites
200+ TB of raw disk space
GPFS as distributed filesystem



Business Grids

Business Grids focus on commercial values

- **Need to support:**
  - On-demand computational power
  - Low cost of ownership
  - Pay-for-use pricing model
  - Economic risk evaluation
  - Capacity planning
  - New Business models
  - Guaranteed QoS
  - Security
  - Trust

- It is vital to adapt the computing model to the business interaction model
- Need to encapsulate business function to make it available to partners: service components.
- Services must be defined by explicit contracts (SLA) to allow independent party access.
  - Consequence is automatic binding.
- Core concern of business is to integrate business processes and functions.
  - Business components are integrated creating service compositions.
  - New value is created through integration/composition.

Our experience

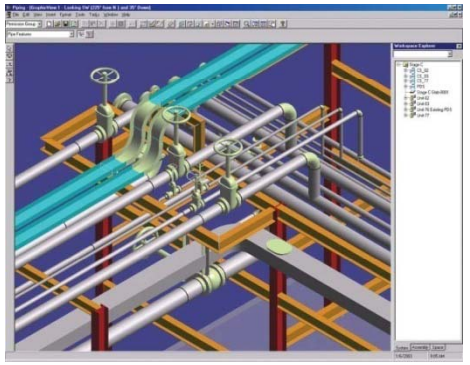
- S-Sicilia has been a 2-year collaboration between the COMETA Consortium and ORACLE to deal with business aspects over Grid.
- The result was a system that:
  - Is based on gLite Grid infrastructure
  - Does not pretend to address all aspects related to Business Grid but be a sort of benchmark
  - Aims to create real business services for SME companies with guaranteed quality
  - Creates a business processes platform over a Grid infrastructure
  - Provides the ability to scale with service demand
  - Position COMETA as a service provider on the medium long term for the R&D and SME world

The S-Sicilia Project

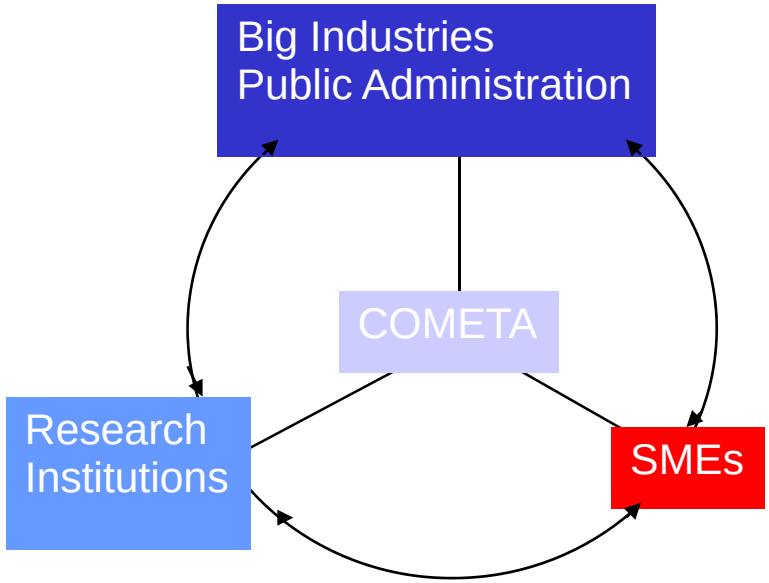
Main features:

- Services are defined and managed through SLAs
- We used WSLA schema
- Contracts are monitored and due actions are taken such as service re-configuration, service re-location and resources re-allocation
- Customers are billed not for raw resources but for services and QoS provided. Contracts are specified in business terms
- The system has been designed to be middleware-independent

- Hosting solution for web applications:
  - e-commerce
  - CMS
  - web-site builders
  - ...
- Test with the ORACLE e-commerce application SOADemo
- Virtualization solution for:
  - Legacy application
  - Productivity software
  - Applications with specific needs, such as OS



Exploitation and Sustainability issues



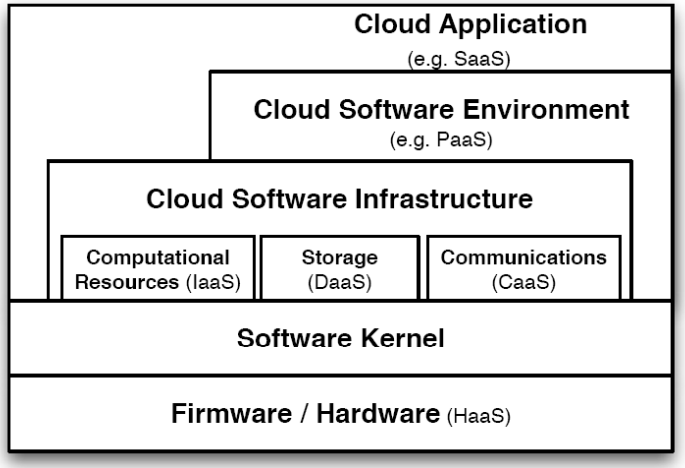
- **QoS and SLA** are crucial issues if GRID has to be opened to the industrial world
- **Security** is a mandatory aspect to be adequately addressed
- **Virtualization** has to be extensively deployed

Supporting *spin-off* initiatives to contribute to the diffusion of Grid knowledge

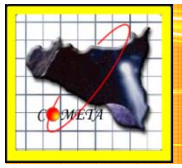
iquadro Insirio Innovazioni

New *spin-off* company focusing on RFID and Grid computing

Cloud's Ontology



1. *Cloud Application Layer:* the most visible layer to the end-users of the cloud. Providing access management (authentication, billing, SLA,…)
   - Web 2.0, services mashup
   - This model is also referred to as *Software as a Service (SaaS).*
     - Salesforce Customer Relationships Management system and Google Apps , Microsoft Azure Service Platform , Sun network.com
2. *Cloud Software Environment Layer:* providers of the cloud software environments supply the users cloud applications' developers with a programming-language-level environment with a set of well-defined APIs.
   - The service provided is referred to as *Platform as a Service (PaaS).*
     - Google's App Engine , Apache Hadoop, Yahoo's Pig
3. *Cloud Software Infrastructure Layer:* provides fundamental resources to other higher-level layers. Services can be categorized into:
   - *Computational resources (VM) - Infrastructure as a Service (IaaS)*
     - Amazon's Elastic Compute Cloud (EC2), Enomalism elastic computing infrastructure, GoGrid Cloud, Windows Azure, IBM Blue Cloud
   - *Data storage - Data as a Service (DaaS)*
     - Distributed file systems (e.g., GFS), replicated relational databases *(RDBMS) (e.g., Bayou) keyvalue* stores (e.g., Dynamo), Amazon's S3 and EMC Storage Managed Service
   - *Communications – Communications as a Service (CaaS)* Network security, dynamic provisioning of virtual overlays for traffic isolation or dedicated bandwidth, guaranteed message delay, communication encryption, and network monitoring
     - Microsoft Connected Service Framework (CSF)
   - SOAP and REST are examples of interface protocols used with some cloud computational resources
4. *Software Kernel:* provides the basic software management for the physical servers that compose the cloud.
   - OS kernel, hypervisor, virtual machine monitor and/or clustering and ***grid middleware***.
   - Globus , Condor, gLite.
5. *Hardware and Firmware:* form the backbone of the cloud. Users of this layer of the cloud are normally big enterprises with huge IT requirements in need of subleasing *Hardware as a Service (HaaS).*
   - *IBM-Morgan Stanley* Morgan Stanley's sublease contract with IBM in 2004.

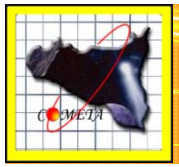


Grid vs Cloud: evolution or revolution?

GRID	CLOUD
JOB-ORIENTED	SERVICE-ORIENTED
USER INTERFACE	WEB 2.0-REST/SOAP
BATCH	INTERACTIVE
INFRASTRUCTURE-RESOURCES-SERVICES KNOWLEDGEMENT	OPACITY: UNKNOWN INFRASTRUCTURE-RESOURCES-SERVICES
STATIC SCHEDULING/DEPLOYMENT	DYNAMIC SCHEDULING/DEPLOYMENT
OPEN/SCIENTIFIC COLLABORATIONS VIRTUAL ORGANISATIONS	COMMERCIAL/BUSINESS-ORIENTED
BEST EFFORT	QoS/SLA
SHARE COMPUTING, DATA AND SCIENTIFIC DISCOVERIES	DATA AND COMPUTING RESOURCES PROTECTION, CONFIDENTIALITY, INTEGRITY

Cloud's Business models-Pricing

- **Pricing models for the different cloud services have taken one of three forms:**
  - ***tiered pricing***: the cloud services are offered in several tiers; each tier offers fixed computing specifications (i.e. memory allocation, CPU type and speed, etc), and SLA at a specific price per unit time.
    - Amazon's cloud systems,
  - ***per-unit pricing***: pay as you go policy, normally applied to data transfers or memory usage.
    - GoGrid Cloud denoted "RAM/hour" as the usage unit for their system.
  - ***subscription-based pricing***: the most-widely used pricing model for *SaaS.* This model allows the users to predict their periodic expenses of using the cloud applications.
- **Per-unit pricing model is more flexible than the tiered pricing, as it allows the users to customize the main memory allocation of their system based on their specific applications' needs.**
- **Subscription-based model is preferred when the computing needs and requirements are regular/constant and/or easy to predict. It lacks the accuracy of charging the users for what they actually have used.**
- **As an alternative there is the *free of charge/advertising model:* services are offered for free, the business, the gain is in the advertisement, the banners (Google Apps).**



Open Questions

How future sustainability of e-Infrastructures can be solved to exploit long term development of technology at industrial and commercial level?

- Can research infrastructures be used to provide commercial services?
- Any common strategy to provide QoS and SLA?
- Is current offered security aligned with commercial requirements?
- Will current Grid Infrastructure be available also in the future so that investments are preserved?
- What about licensing?

Are we ready for a Cloudness?

Expertise in Grid, application porting, service tailoring are the qualifying elements against commercial solutions.

Many Thanks

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