



Cloud Computing in ENEA-GRID: Virtual Machines, Roaming Profile, and Online Storage

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Pool of technologies and instruments able to export services in the net

Typical Services:

- Storage/Archiving
- Data elaboration
- Remote Software
- Virtualization

Advantages for users:

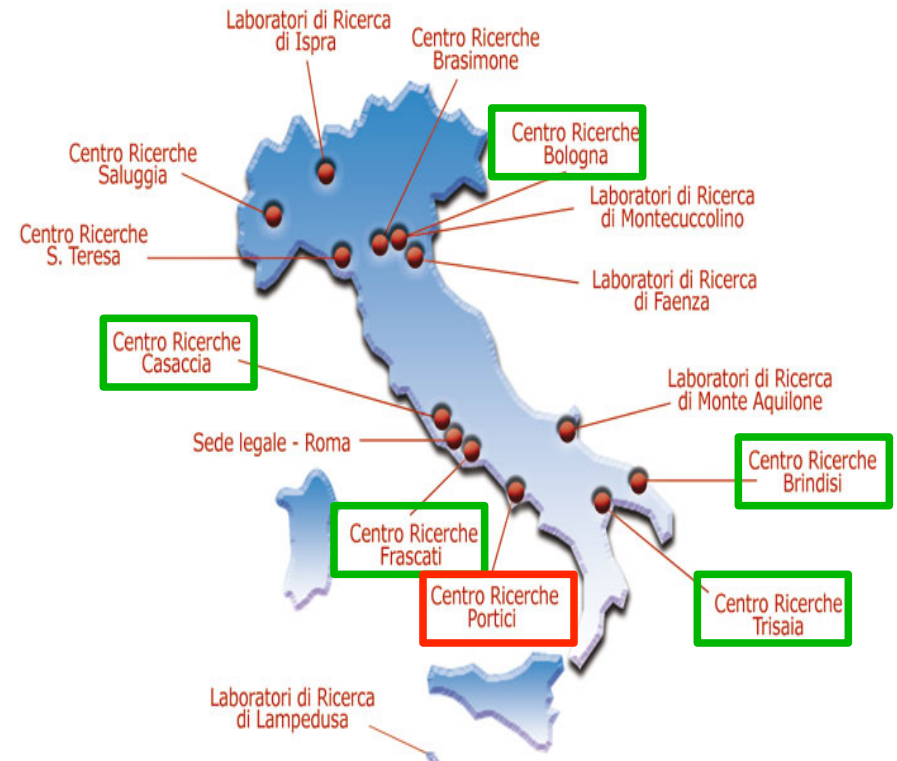
- Ubiquitous data and resources access
- Device independance
- User-friendly interface and simple usage
- Saving of HW and SW cost and maintenance operations



ENEA-GRID

ENEA computational centers
connected each other by the
GARR network

- More than 50Tflops (integrated power) and over 6000 cores (CRESCO HPC clusters)
- Integration of computational resources, storage systems, and monitoring tools
- A unified environment and homogeneous access for ENEA researchers
- Optimized resource usage
- Multi-platform systems for serial and parallel computations (HPC)



Early Approach

- Software and services in the GRID
- ENEA Virtual Labs
(web access to software, tools, and docs related to a specific domain)
- Storage in GRID (OpenAFS)
- GPFS multisite
(multiclustert over WAN – *recently enabled*)

Recent Approach

- Testing ENEA-GRID infrastructure in supporting Virtual Machines customized on user requirements, employing OpenNebula as cloud platform.
(GARR Conference - November 2011)
- OpenNebula is a versatile tool and supports interoperation of heterogeneous cloud and services (e.g., OCCl)

Motivations to enhance Cloud services in ENEA-GRID

Providing **user-oriented VMs**, which can be used to support ENEA-GRID users in their common activities (not only regarding HPC)

Requirements

- VMs should be *customized on user needs*
- Providing support to **legacy applications**
- VMs should **access user data** in ENEA-GRID
- There should be an **easy way to share and transfer data** from and to the VMs
- Store **user personalizations and environment** (profile)

Infrastructure **also** suitable to provide **service-oriented VMs**

Newest Approach

To enhance virtual machine supply
by introducing ***user roaming profiles***
and ***online storage*** for data exchange

Advantages

- Handling user roaming profiles (both for Windows and Linux systems) allows to save user personalizations and settings on his VMs
- Online storage facility allows to easily exchange data from and to VM
- Both roaming profile and online storage exploit AFS as storage system in cloud environment and Kerberos5 for authentication

User Roaming Profiles for VMs



- VMs join ENEA.IT domain
 - Authentication with Krb5
- AFS is employed to store user profile data
 - One profile for each VM template available
- Users login into VMs with their ENEA-GRID credential
 - After login, users can access to their AFS home in ENEA-GRID to share data among VMs
 - *No need for creating local accounts in VMs!!!*
- VMs can be destroyed after usage without losing user data, as they are stored on AFS
 - Optimized usage of infrastructure resources

- A typical challenge in cloud systems and in VM context concerns the ***data exchange issue***
 - Users want to transfer data from and to their VMs in a easily way
- ENEA provides an own solution by proposing **OKBox**

OKBox

Service for distributed storage system which allows to share data easily in ENEA-GRID cloud



Main features:

- It exploits IaaS strategy and “Always and Anywhere On” cloud paradigm
- Web access (pervasive) to distribute resources in AFS
- Drag-and-drop file upload
- Possibility of sharing data among ENEA-GRID users and also among other people (non ENEA-GRID users)
- Security policies and privacy preserving mechanisms (no use of third-part storage solutions)

OKBox – Login Interface

ENEA OKBOX Login

Login

Password

I'm an ENEA-Grid user

☐

Take me to:

My Own Box

A Project's Box

Another User's Box

Log-in

- Login credentials
- ENEA-GRID user flag
- Access points
 - Own box
 - Project box
 - Another user box

OKBox – User Interface



Logged in as **gponti**  Logout

 Up one level  New folder  Share the current folder
 Delete  Rename  Generate link  Upload

/afs/enea.it/por/user/gponti/public_okbox/

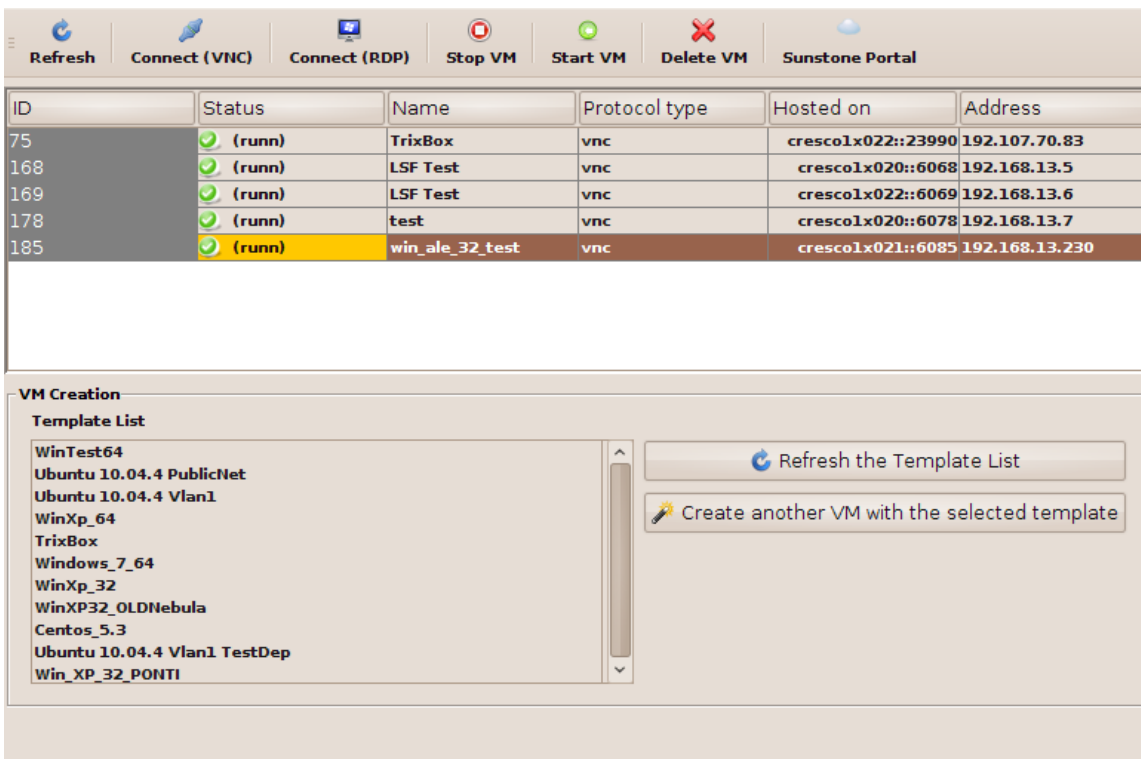
	Filename	Type	Last Modified	Size
☐	casa	directory	Nov 28 00:20	-
☐	prova	directory	Nov 23 10:56	-
☒	2012_11_30_PONTI_ENEA_GRID_CLOUD.pdf	file	Nov 28 00:46	1026662
☐	2012_11_30_PONTI_ENEA_GRID_CLOUD.ppt	file	Nov 28 00:47	1268736

- Data area (files and dir)
- User operations

Accessing the VMs

Ways to access to the VMs

- ENEA-GRID FARO Web Portal (ad-hoc interface)



The screenshot displays the ENEA-GRID FARO Web Portal interface. At the top, there is a navigation bar with icons and labels for 'Refresh', 'Connect (VNC)', 'Connect (RDP)', 'Stop VM', 'Start VM', 'Delete VM', and 'Sunstone Portal'. Below this is a table listing VMs with columns for ID, Status, Name, Protocol type, Hosted on, and Address. The table contains five entries, with the last one, 'win_ale_32_test', highlighted in yellow. Below the table is a 'VM Creation' section with a 'Template List' on the left and two buttons on the right: 'Refresh the Template List' and 'Create another VM with the selected template'.

ID	Status	Name	Protocol type	Hosted on	Address
75	✓ (runn)	TrixBos	vnc	crescolx022::23990	192.107.70.83
168	✓ (runn)	LSF Test	vnc	crescolx020::6068	192.168.13.5
169	✓ (runn)	LSF Test	vnc	crescolx022::6069	192.168.13.6
178	✓ (runn)	test	vnc	crescolx020::6078	192.168.13.7
185	✓ (runn)	win_ale_32_test	vnc	crescolx021::6085	192.168.13.230

VM Creation

Template List

- WinTest64
- Ubuntu 10.04.4 PublicNet
- Ubuntu 10.04.4 Vlan1
- WinXp_64
- TrixBos
- Windows_7_64
- WinXp_32
- WinXP32_OLDNebula
- Centos_5.3
- Ubuntu 10.04.4 Vlan1 TestDep
- Win_XP_32_PONTI

Refresh the Template List

Create another VM with the selected template

- Simple interface wrapping OpenNebula APIs to execute most common operations on VMs (e.g., create, stop, delete)
- Accessing protocols VNC and RDP
- OpenNebula ACLs on users and group employed for better managing templates and physical resources

- OpenNebula Sunstone web portal (for advanced users)

Cloud Infrastructure:

- 3 IBM x3850/x3950-M2 nodes with:
 - 4 Xeon Quad-Core Tigerton E7330 (2.4GHz/1066MHz/6MB L2)
 - 32 Gb RAM
- Total amount of physical resources:
 - 48 cores
 - 96 Gb RAM
- 1 node running OpenNebula processes, scheduler, and Sunstone Web Portal

VM Template Info:

- *Operating System:* Windows XP 32bit SP3
- *CPU:* 1 physical CPU per VM
- *RAM:* 1 Gb per VM

Purpose

Assessing the responsiveness of the VMs

Two-stage test:

1. TEST 1: Standard loaded infrastructure
(physical resources yet available)

- Up to 48 VMs

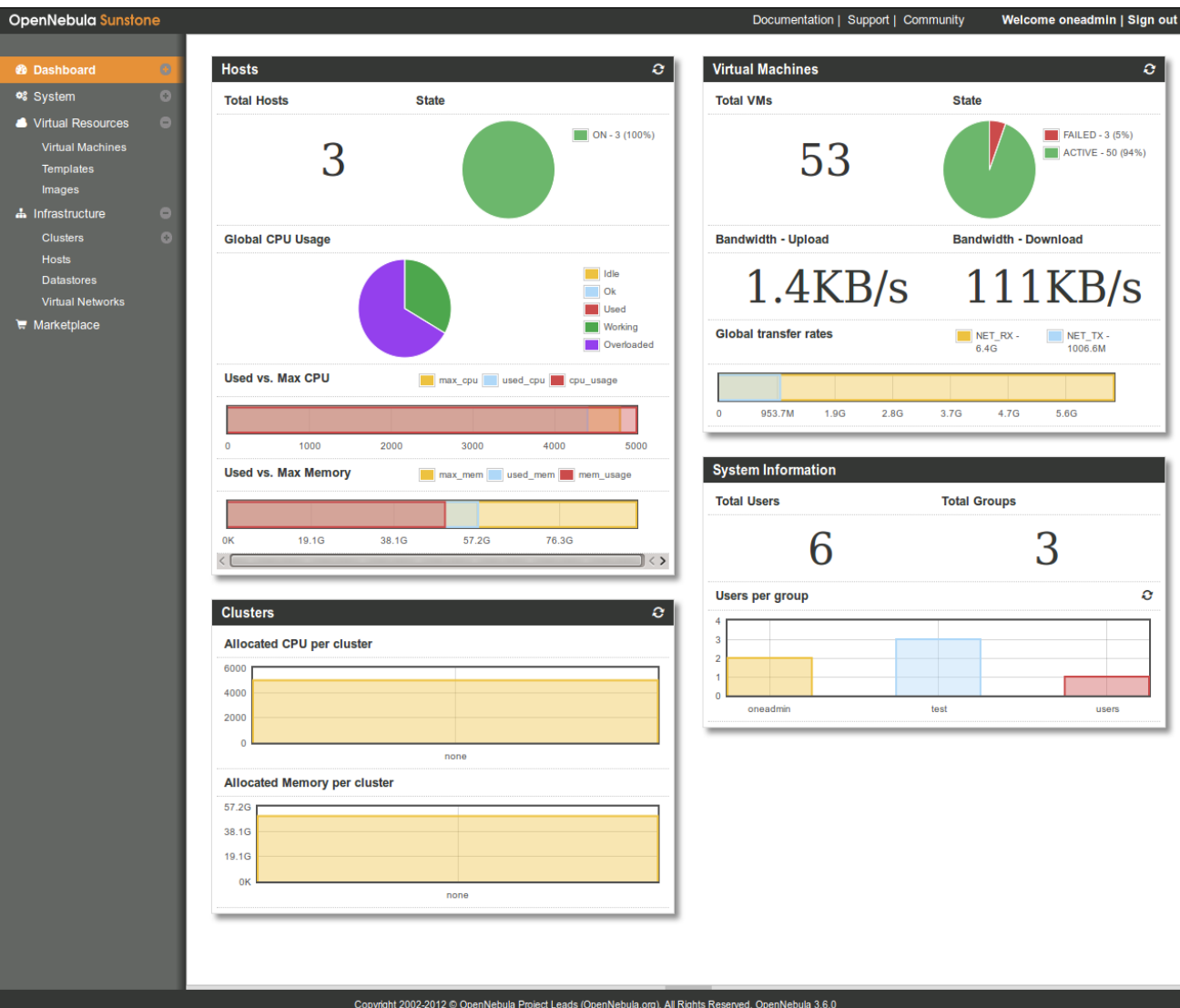
2. TEST 2: Overloaded infrastructure
(physical resources partially overloaded)

- More than 48 VMs

VM Status:

- Each VM has its CPU fully busy (100%)
- Factorization of large integers (process task executed)

Testing the Cloud Infrastructure (3)



Results:

- TEST 1:**
System highly responsive
- TEST 2:**
System yet responsive and VMs usable for common user activities (e.g., web browsing, document editing, etc...)

- We presented the cloud infrastructure in ENEA-GRID based on OpenNebula
- We aimed to provide disposable VMs for user purposes

Key features of our proposal:

- User exploited VM integration in ENEA-GRID by means of:
 - Centralized roaming profile;
 - Online data exchange storage solution (ENEA OKBox)
- Easy access via FARO Web Portal
- Infrastructure supporting our objective (stress test)

Ready to be released for ENEA-GRID users



Thanks!

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ENEA-GRID/CRESCO

<http://www.cresco.enea.it/>