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Faculdade de Engenharia

# Web System For Creating And Managing Virtual High Performance Computing Environments

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# Agenda

1. The Problem
2. Motivation and objectives
3. Cloud Middleware
4. The Solution
5. Conclusions
6. Future work



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# 1 - The Problem



# The problem

- Grid computing infrastructures
  - Inflexible
- Cloud Computing infrastructures
  - Adapt to the code
- Using computing infrastructures
  - Sometimes more knowledge is needed
- Leads to a lack of growth in the use of these infrastructures



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# CICA's Private Cloud Project



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# CICA's Private Cloud Project

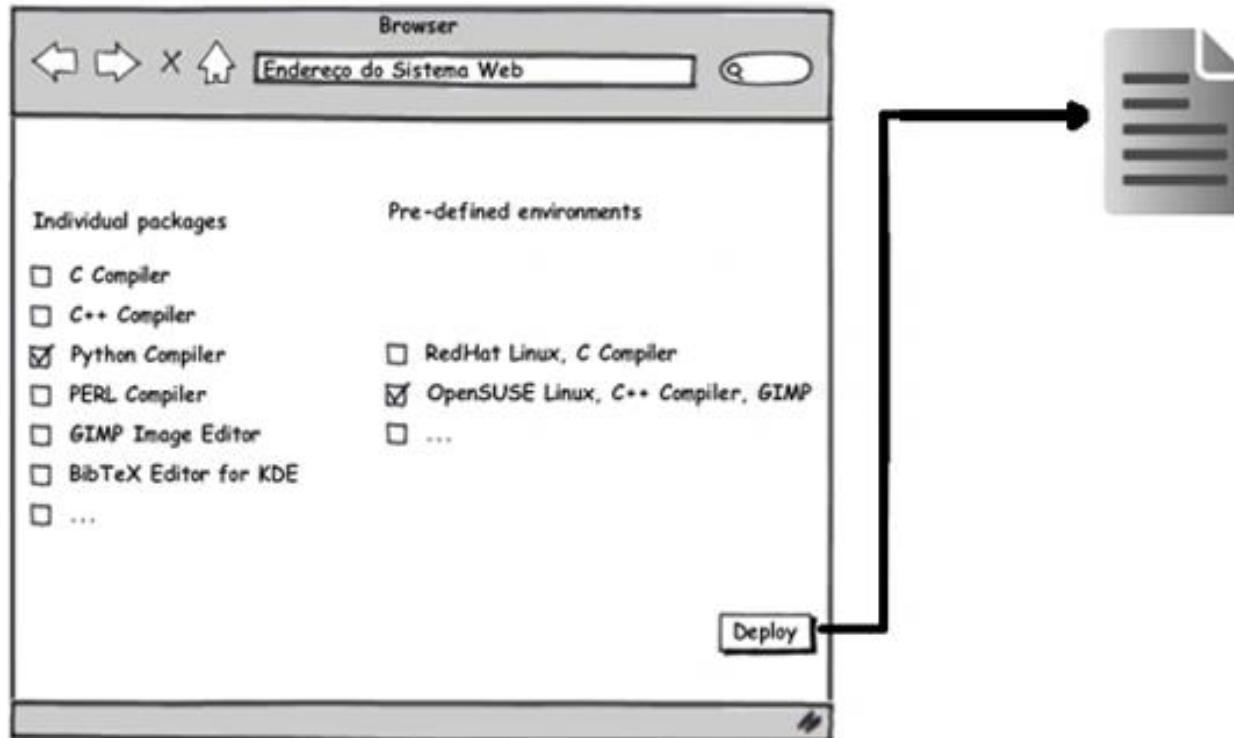


Researcher  
needs to run a  
computing job



# CICA's Private Cloud Project

## Web System





# CICA's Private Cloud Project

Clusters







# CICA's Private Cloud Project

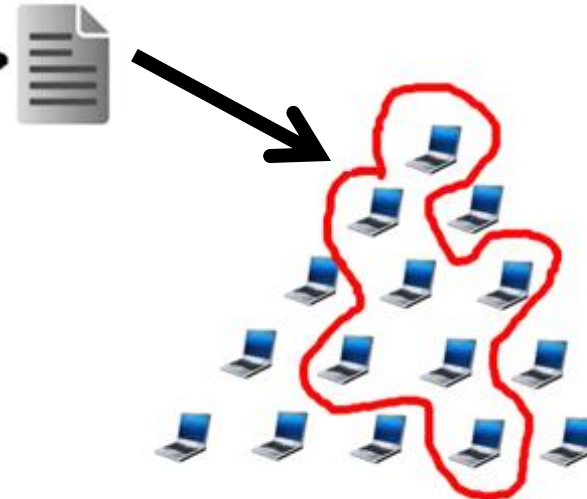


User needs to  
run a  
computing job

Web System



Clusters





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# Motivation



# Motivation

- Direct application in FEUP's infrastructures
- Different area of Informatics
- Growing area in Informatics



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# Objectives



# Objectives I

- Improve FEUP's computing system by making it:
  - More used
  - More usable
- Create a web system which allows the user to interact with the computing infrastructures in an easy and intuitive way



# Objectives II

- Web system:
  - Create VM images
    - Must be dynamic
  - Help the users choose a suitable VM image for their computing job
  - Manage VM images



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# Cloud Middleware



# Cloud Middleware

- Two major cloud middleware projects:



- In this project:
  - OpenStack.





# Why OpenStack?

- More recent
- Support from the industry



- Surpassed OpenNebula in terms of:
  - Code
  - Contributors
- Programming language

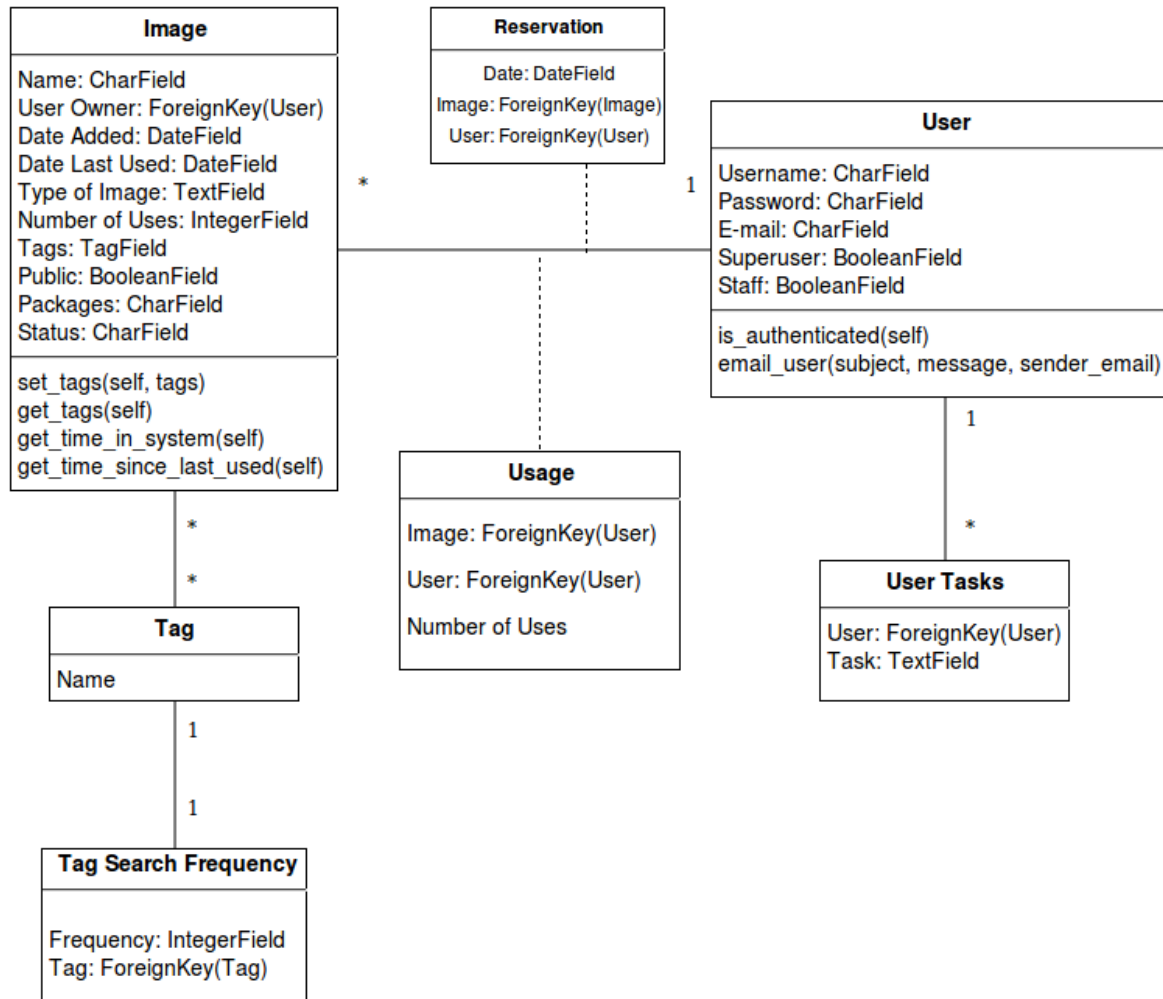


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# The solution



# UML





# Web System

Hello [Pedro Teixeira](#) | [Image management](#) | [Logout](#)

## Web System For Creating And Managing Virtual High Performance Computing Environments

This portal was designed to help researchers find the most suitable virtual image for their computing needs.  
Please choose one of the options below to continue:



View statistics



Launch an already  
existing VM image



Create a new VM  
image



Search for a VM image



# VM Image Creation

Hello [Pedro Teixeira](#) | [Image management](#) | [Logout](#)

## Web System For Creating And Managing Virtual High Performance Computing Environments

### Create a VM image

**NAME**

**NOTE:** Do not use special characters. Use only alphanumerical characters, upper or lower case (a-z; A-Z; 0-9). The name will be converted to uppercase for convenience.

**TAGS**

**NOTE:** Separate different tags by using commas. Example: ubuntu, vim, this is science.

**DESCRIPTION**

**NOTE:** Write a short description about the VM you are about to create.

**PUBLIC** ☐

**NOTE:** Check the box if you wish to share the VM image with the rest of the users.

Please choose from the applications below those you wish to be included in your VM:

- VIM** ☐
- MATLAB** ☐
- ABAQUS** ☐
- GCC** ☐
- R** ☐
- OCTAVE** ☐
- GROMACS** ☐
- OPENFOAM** ☐
- ANSYS** ☐

[Go back to the start page](#)



# Launch a VM Image

Hello [Pedro Teixeira](#) Administration: [Image management](#), [Logout](#)

## Web System For Creating And Managing Virtual High Performance Computing Environments

**The Virtual Machine image was successfully created and added to the database.**

The VM is being prepared. A warning will appear once the process is complete.  
To access the VM, SSH into

192.168.0.101

using the following login and password combination:

Login: user  
Password: password

[Go back to the start page.](#)



# Helping the user

- Set of statistics
  - Most used VMs
    - By the user
    - Across the system
  - Tag Cloud
  - Most searched Tags
- Search for a VM image



# Most used VMs

## Most used images by you

These are the most used images by you. You may consider reusing them instead of creating a new one.

CHEM\_IMG

CHEMISTRY MATLAB

LAST USED IN July 1, 2012

TIMES USED 8

DESCRIPTION Organic Chemistry

[LE\\_IMAGE](#)

GCC LATEX PROGRAM1 PROGRAM2 TEX VIM

LAST USED IN July 7, 2012

TIMES USED 1

DESCRIPTION Image created for producing C code. LaTeX is included for report production. Program1 is vital for this, Program2 as well.





# Most used VMs

## Most used VM images in the system

These are the most used VM images currently in the system. If you believe one of these images may help you, but you do not have access to it, contact either the VM image creator or the system administrator so that they can set their image to "Public". Their contacts are displayed next to the image they created.

### IMAGE\_OF\_ALL\_IMAGES

**ANSYS** **CANCER RESEARCH** **FOLDING** **LIFE** **OPENFOAM**

**CREATOR** Chuck Norris **EMAIL** motherofallemails@email.com

**TIMES USED** 9001

**DESCRIPTION** Folding environment. FOLDING@HOME project VM image, for test purposes.

### CHEM\_IMG

**CHEMISTRY** **MATLAB**

**CREATOR** Pedro Teixeira **EMAIL** ei05057@fe.up.pt

**TIMES USED** 8

**DESCRIPTION** Organic Chemistry

### INF\_IMAGE

**ECLIPSE** **GCC** **LATEX**

**CREATOR** Bart Simpson **EMAIL** notbartsimpson@springfield.com

**TIMES USED** 1

**DESCRIPTION** Environment for compiling C++ code and creating documentation



# Most searched tags

## Most searched tags in the system

This shows the most searched tags in the system and which images are tagged with them.

**GCC** INF\_IMAGE | [LE\\_IMAGE](#)

TIMES SEARCHED 22

**VIM** [LE\\_IMAGE](#)

TIMES SEARCHED 16

**MATLAB** CHEM\_IMG

TIMES SEARCHED 11

**PROGRAM1** [LE\\_IMAGE](#)

TIMES SEARCHED 6

**PROGRAM2** [LE\\_IMAGE](#)

TIMES SEARCHED 6

**GHOST POKEMON**

TIMES SEARCHED 3

**TEX** [LE\\_IMAGE](#)

TIMES SEARCHED 2

**LIFE** [IMAGE\\_OF\\_ALL\\_IMAGES](#)

TIMES SEARCHED 1

[Go back to the start page.](#)



# Tag Cloud

## Tag Cloud

This shows the current tag usage in the VM images in the system. A bigger font means a higher use of that tag.

ANSYS [IMAGE OF ALL IMAGES](#) BETAO [CIVIL IMAGE](#) BRIDGES [CIVIL IMAGE](#) CANCER RESEARCH [IMAGE OF ALL IMAGES](#) CHEMISTRY [CHEM IMG](#) CIVIL ENG [CIVIL IMAGE](#) CONCRETE [CIVIL IMAGE](#)

ECLIPSE [INF IMAGE](#) FOLDING [IMAGE OF ALL IMAGES](#) **GCC** [MECH IMG](#) [INF IMAGE](#) [LE IMAGE](#) LATEX [INF IMAGE](#) [LE IMAGE](#) LIFE [IMAGE OF ALL IMAGES](#) **MATLAB** [MECH IMG](#) [CHEM IMG](#)

PROGRAM2 [LE IMAGE](#) TEX [LE IMAGE](#) **VIM** [MECH IMG](#) [LE IMAGE](#) MECHANICAL ENG [MECH IMG](#) OPENFOAM [IMAGE OF ALL IMAGES](#) PROGRAM1 [LE IMAGE](#)



# Search for a VM image

## Web System For Creating And Managing Virtual High Performance Computing Environments

### Search

Use commas (",") to separate search terms, e.g. chemistry, organic chemistry, matlab

[Go back to the start page](#)



# Search results

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**Web System For Creating And Managing Virtual High Performance Computing Environments**

You searched for: **GCC, VIM, MATLAB, PROGRAM1, PROGRAM2**

Found 3 Images:

**INF\_IMAGE**

**ECLIPSE** **GCC** **LATEX**

**CREATOR** Bart Simpson **EMAIL** notbartsimpson@springfield.com

**TIMES USED** 1

**DESCRIPTION** Environment for compiling C++ code and creating documentation

**LE\_IMAGE**

**GCC** **LATEX** **PROGRAM1** **PROGRAM2** **TEX** **VIM**

**CREATOR** Pedro Teixeira **EMAIL** ei05057@fe.up.pt

**TIMES USED** 1

**DESCRIPTION** Image created for producing C code. LaTeX is included for report production. Program1 is vital for this, Program2 as well.

**CHEM\_IMG**

**CHEMISTRY** **MATLAB**

**CREATOR** Pedro Teixeira **EMAIL** ei05057@fe.up.pt

**TIMES USED** 8

**DESCRIPTION** Organic Chemistry

[Go back to the start page](#)



# Management

- Two types:
  - Image
  - Users



# Image Management I

## Web System For Creating And Managing Virtual High Performance Computing Environments

Welcome to the admin reserved area, Pedro Teixeira.

The following VM images have been in the system for over 10 days and have not been used for 10 days. You should consider deleting them.

CHEM\_IMG

**CHEMISTRY** **MATLAB**

**CREATOR** Pedro Teixeira **EMAIL** ei05057@fe.up.pt

**LAST USED IN** July 1, 2012

**ADDED TO THE SYSTEM ON** July 1, 2012

Images marked for deletion:

CHEM\_IMG is in the system for **15** days. It has been **15** days since it was last used.

**CREATOR** Pedro Teixeira **EMAIL** ei05057@fe.up.pt



# Image Management II

## Images currently in the system:

CHEM\_IMG is in the system for **15** days. It has been **15** days since it was last used.

**CREATOR** Pedro Teixeira **EMAIL** ei05057@fe.up.pt

INF\_IMAGE is in the system for **45** days. It has been **6** days since it was last used.

**CREATOR** Bart Simpson **EMAIL** notbartsimpson@springfield.com

CIVIL\_IMAGE is in the system for **3** days. It has been **3** days since it was last used.

**CREATOR** Megatron Silva **EMAIL** decepticons@decepticorp.com

IMAGE\_OF\_ALL\_IMAGES is in the system for **15** days. It has been **2** days since it was last used.

**CREATOR** Chuck Norris **EMAIL** motherofallemails@email.com

LE\_IMAGE is in the system for **45** days. It has been **9** days since it was last used.

**CREATOR** Pedro Teixeira **EMAIL** ei05057@fe.up.pt

[Go back to the start page](#)

III





# User Management I

Hello [Pedro Teixeira](#) | [Image management](#) | [Logout](#)

## Web System For Creating And Managing Virtual High Performance Computing Environments

### User information

USERNAME pedro  
FIRST NAME Pedro  
LAST NAME Teixeira  
EMAIL ei05057@fe.up.pt

### User details

#### VM images created

CHEM\_IMG

CHEMISTRYMATLAB

DATE ADDED July 1, 2012

LAST USED IN July 1, 2012

DESCRIPTION Organic Chemistry

LE\_IMAGE

GCCLATEXPROGRAM1PROGRAM2TEXVIM

DATE ADDED June 1, 2012

LAST USED IN July 7, 2012

DESCRIPTION Image created for producing C code. LaTeX is included for report production. Program1 is vital for this, Program2 as well.

[Go back to the start page](#)



# User Management II

**Administration** Welcome, **Pedro**. [Change password](#) / [Log out](#)

[Home](#) > [Auth](#) > [Users](#)

### Select user to change

Action:  0 of 8 selected

<input type="checkbox"/>	Username	E-mail address	First name	Last name	Staff status
<input type="checkbox"/>	chem_user	chamist@chemistry.com	Chemist	Chemistson	⊖
<input type="checkbox"/>	chuck	motherofallemails@email.com	Chuck	Norris	⊕
<input type="checkbox"/>	decepticon	decepticons@decepticoncorp.com	Megatron	Silva	⊖
<input type="checkbox"/>	el_barto	notbartsimpson@springfield.com	Bart	Simpson	⊖
<input type="checkbox"/>	mech_user	autobots@thisisanemail.com	Optimus	Prime	⊖
<input type="checkbox"/>	pedro	ei05057@fe.up.pt	Pedro	Teixeira	⊕
<input type="checkbox"/>	pokemans	ketchum@silkcorp.com	Ash	Ketchum	⊖
<input type="checkbox"/>	spongebob	pineapple@underthesea.com	Spongebob	Squarepants	⊖

8 users

**Filter**

- By staff status**
  - All
  - Yes
  - No
- By superuser status**
  - All
  - Yes
  - No
- By active**
  - All
  - Yes
  - No



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# Conclusions



# Conclusions

- Improvements over OpenStack:
  - More user friendly
  - VM image management
  - Searching for a VM
- Dynamic VM image creation
- User is able to benefit from previously created VM images – time is decreased by 50%
- Simple system, with visual aids and textual help



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# Future Work



# Future Work

- Full integration with OpenStack;
- Ability to customize existing VM image
  - User owned software
- Dynamic package insertion
  - Right now: Hardcoded
  - Improvement: Search repositories upon the image creation
- Ability to schedule the creation of a VM image
- Management outside the web system
- Possible to expand the use of the web system to other facilities