



E-infrastructure shared between Europe and Latin America

The EELA Project

Inês Dutra – COPPE/UFRJ

*Second Grid School
XXVII Congresso da SBC
IME/RJ, 05.07.2007*

Realização Promoção



Rio de Janeiro
SBC 2007

30 DE JUNHO A 06 DE JULHO DE 2007

www.eu-eela.org





- **What is EELA?**
- **Objectives**
- **Partners**
- **Organization**
- **WP2: Infrastructure**
- **WP3: Applications**
- **WP4: Dissemination**



E-infrastructure shared between Europe and Latin America

What is EELA?

- **E-infrastructure shared between Europe and Latin America**
- **2-year project financed by the European Union**
- **Start date: 1/01/2006**
- **Total budget: 2,568,320 €**
- **Funding from the EC: 1,700,000 €**
- **Total effort in person-month: 1109**
- **Web site: www.eu-eela.org**
- **Contact person:
Ramón Gavela
email: ramon.gavela@ciemat.es**



Objectives

- Establish a collaboration network between European institutions where Grid expertise **exists** (e.g. EGEE project), and Latin American institutions where Grid activities are **emerging**.
- Set up a pilot e-Infrastructure in LA, interoperable with the EGEE one in Europe, allowing to run enhanced applications, thus enabling dissemination of knowledge and experience on Grid technology.
- Ultimately set up a steady framework for e-Science collaboration between Europe and Latin America.

Human Network!!!



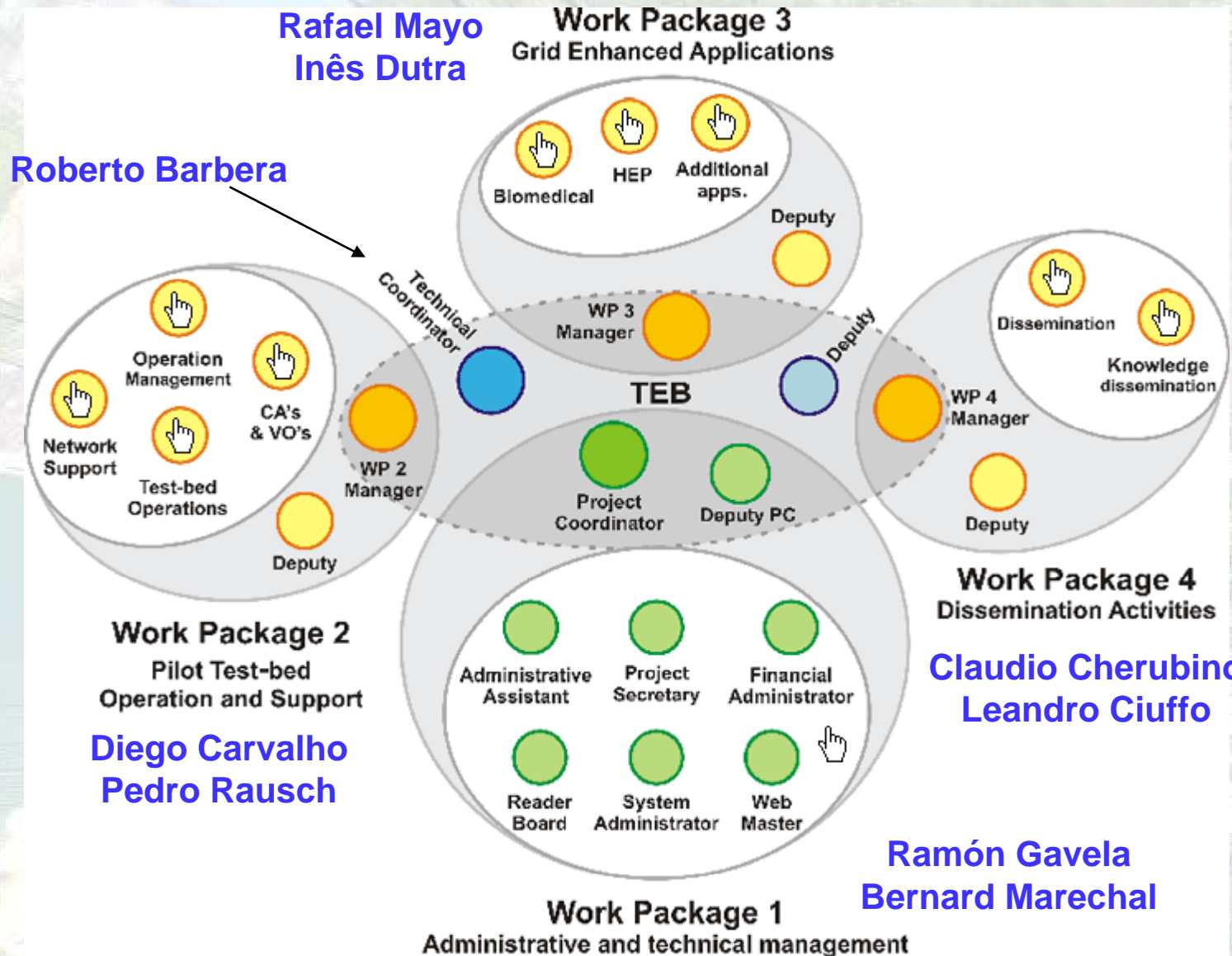
E-infrastructure shared between Europe and Latin America

EELA PARTNERS

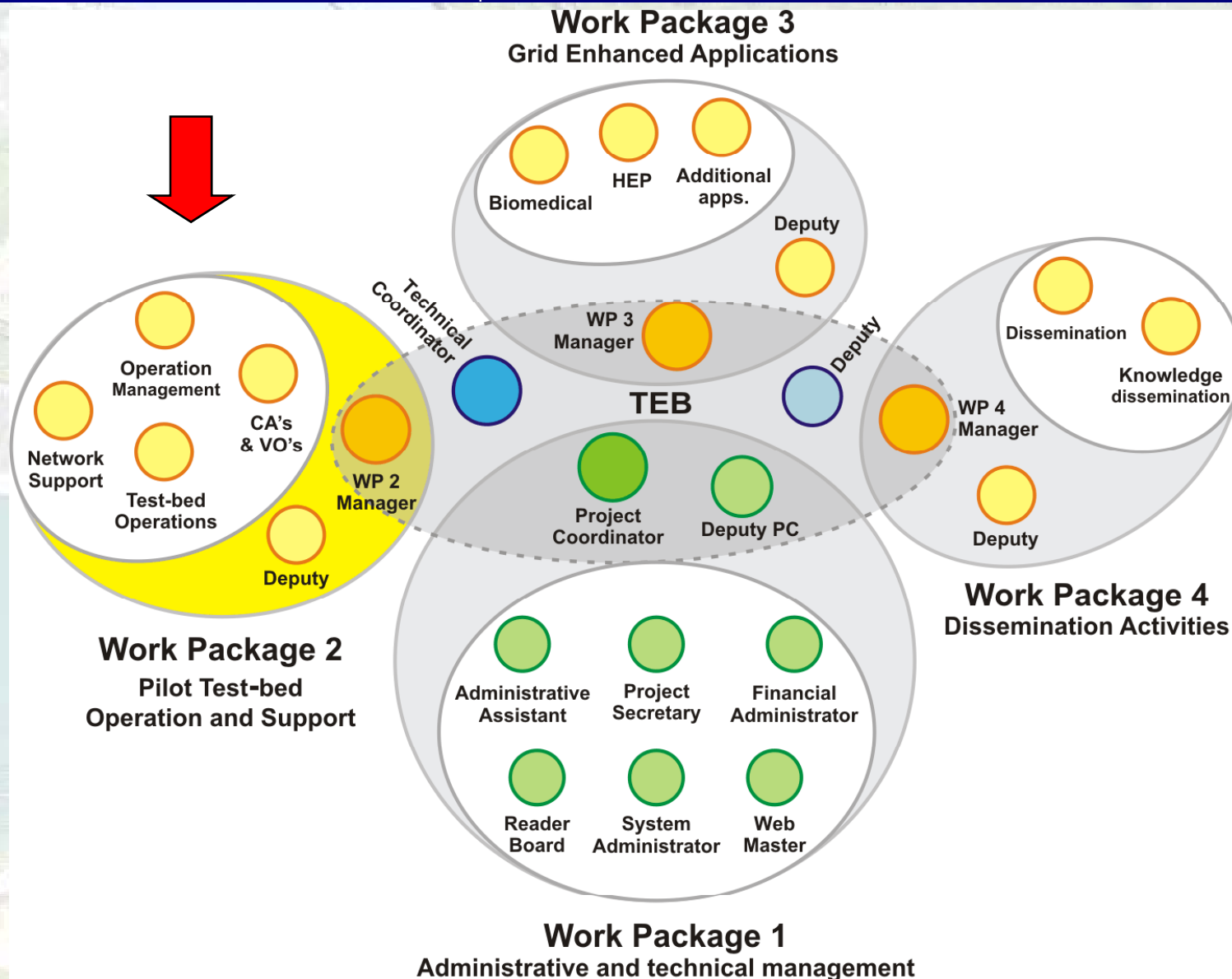
Italy: INFN
Portugal: LIP
Spain: CIEMAT, CSIC, Red.ES, UC, UPV
CERN

Argentina: UNLP
Brazil: CEDERJ, RNP, UFF, UFRJ
Chile: REUNA, UDEC, UTFSM
Cuba: CUBAENERGIA
Mexico: UNAM
Peru: SENAMHI
Venezuela: ULA
CLARA

- 10 Countries
- 21 Partners



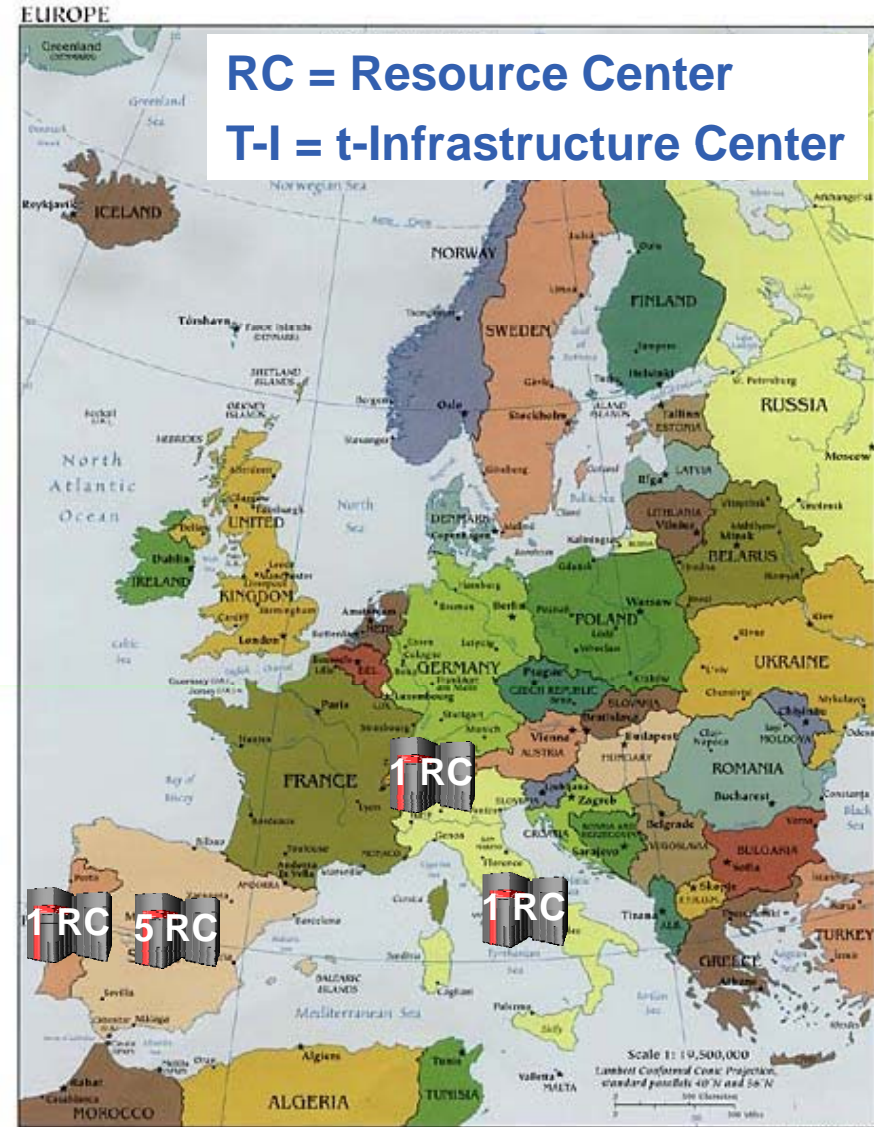
WP2: Infrastructure





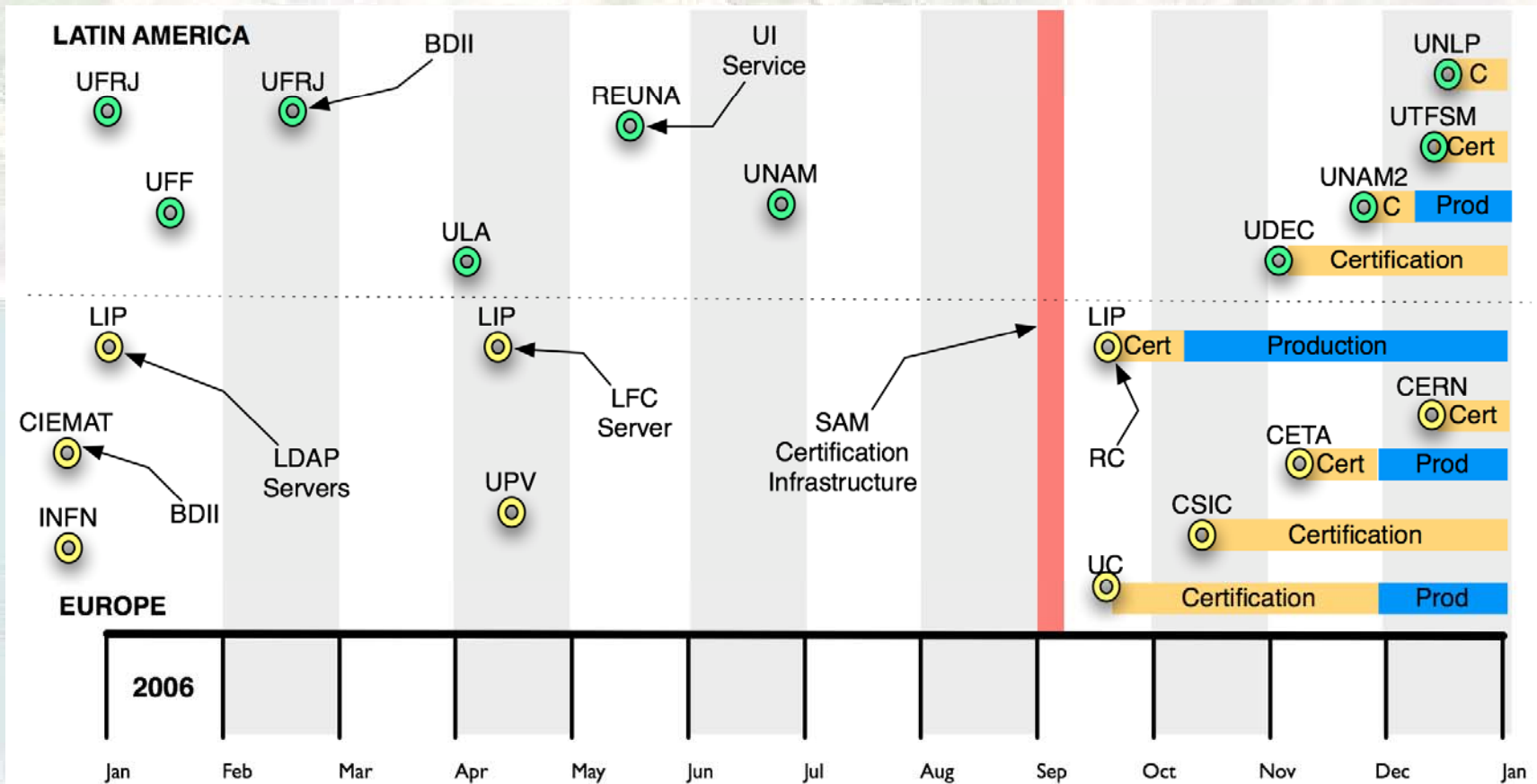
WP2: The EELA Pilot Test-bed

E-infrastructure shared between Europe and Latin America

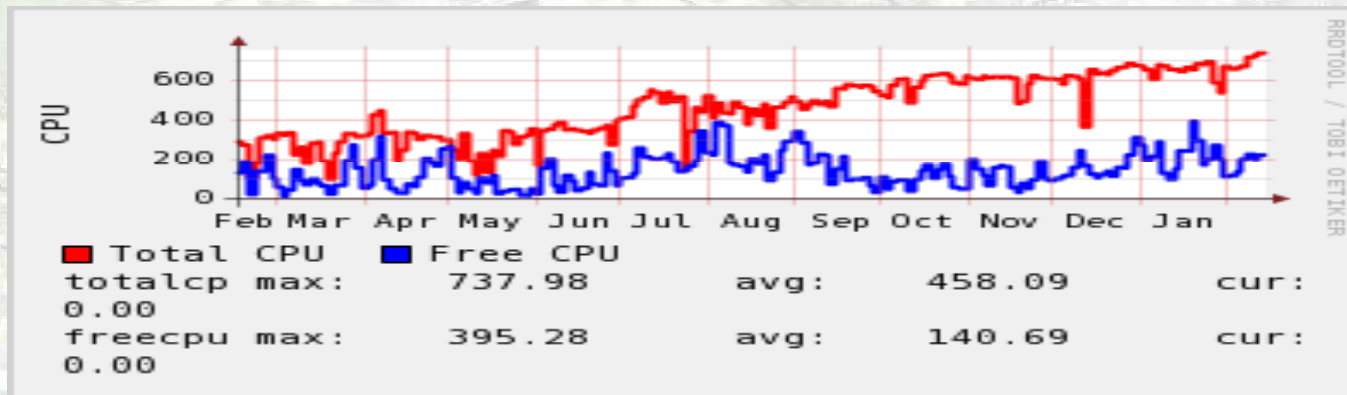


WP2: number of sites

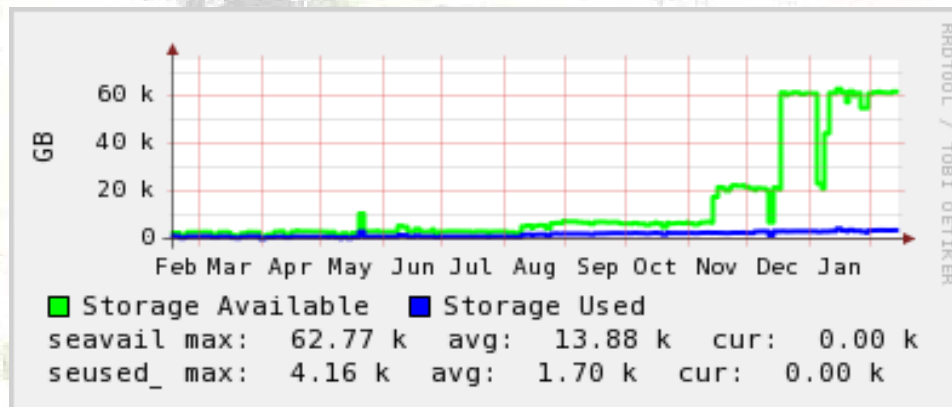
- *Evolution of the number of sites integrating the e-Infrastructure*



- *Resources integrated into the Test-bed*



CPU Slots evolution

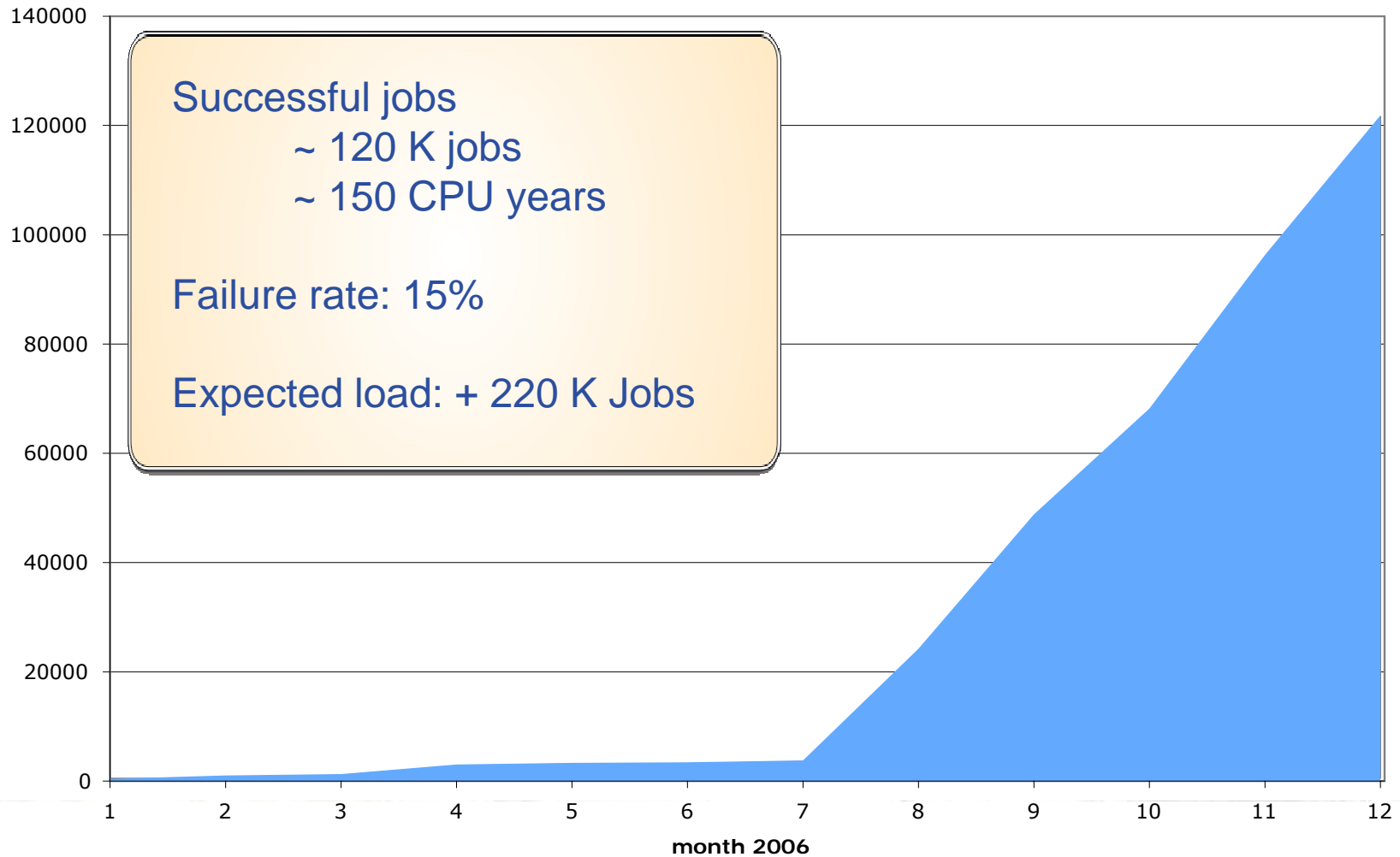


Storage Capacity evolution

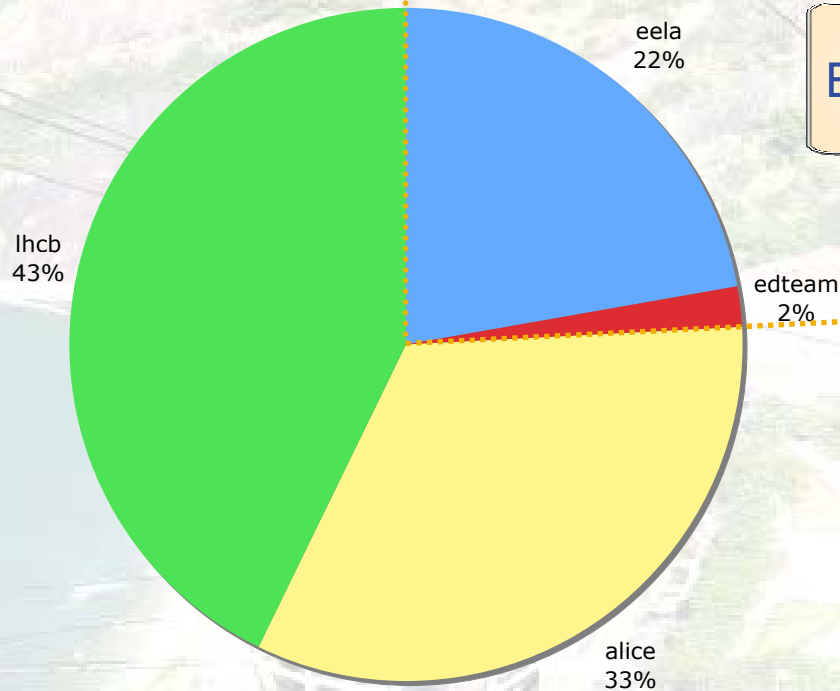
Production sites (source GStat)

WP2: Use of the infrastructure

- **Statistics of use of the Pilot Test-bed**

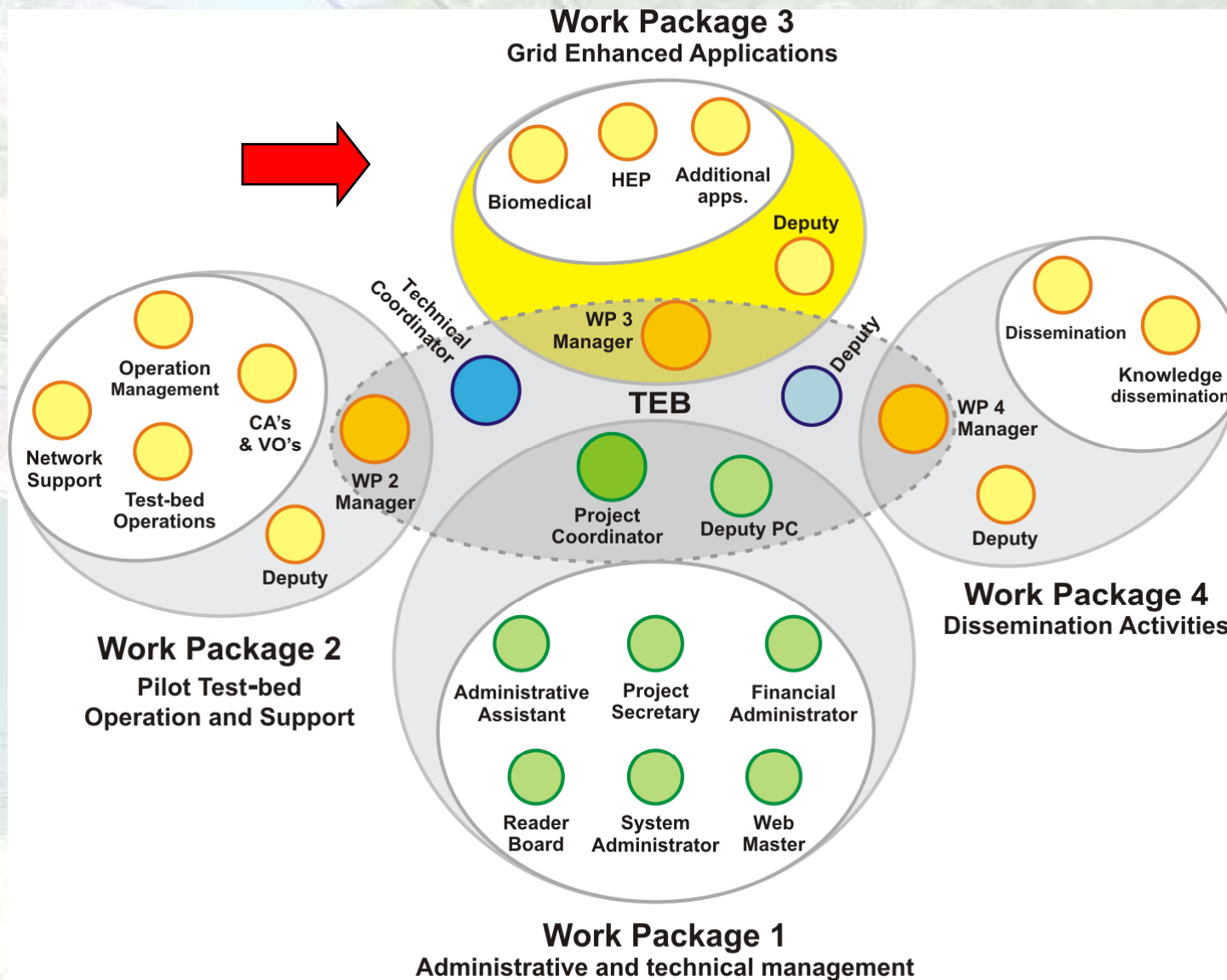


- **Statistics of use of the Pilot Test-bed**



EELA specific VOs used 36 CPU.year

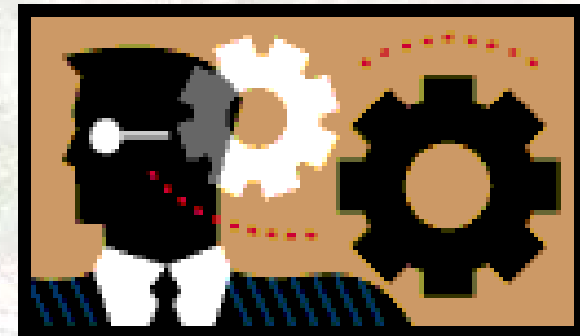
VO % of time use



OVERVIEW

APPLICATIONS

- 3.1 Biomed
- 3.2 HEP
- 3.3 e-Learning & Climate



- **WP3: Identification and support of Grid enhanced applications**
 - **Coordinated by CIEMAT**
 - **Identifies, selects and customizes relevant applications and tools suitable for the Grid dissemination process in:**
 - **T3.1 Biomedicine (CUBAENERGIA, ULA, UPV)**
 - **T3.2 High Energy Physics (CERN, CIEMAT, UFRJ, UNAM, UNLP, UTFSM)**
 - **T3.3 Additional Applications**
 - *e-Education (CECIERJ/CEDERJ, CIEMAT, CUBAENERGIA, UFRJ, UNAM)*
 - *Climate (UC, UDEC, SENAMHI)*
 - **Aims at being the place of information exchange between already gridified applications and future ones.**

- GATE.
- Malaria Docking: WISDOM.
- Blast in Grids: BiG.
- Phylogeny.
- **Participants: UPV (Coordinator: Vicente Hernández), CUBAENERGIA, ULA.**

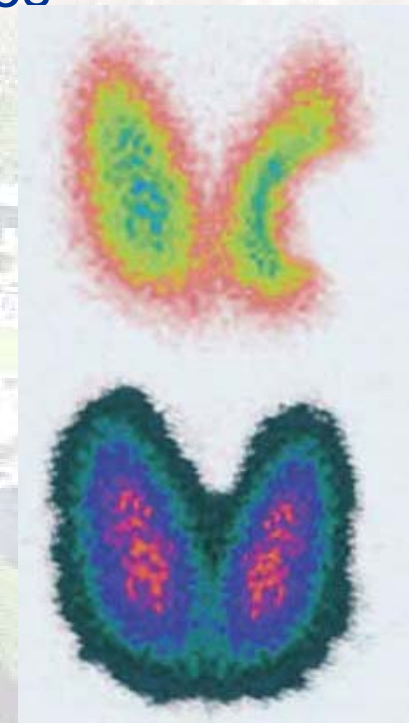


- **Problem Addressed**

- The computation of the doses in radiotherapy treatments is performed through analytical simplified models
- Environment for the Monte-Carlo simulation of particle physics emission in the medical field that is more accurate specially when dealing with heterogeneous tissues
- Very time-consuming

- **User Community**

- The interest of the LA community is led by CUBAENERGÍA
- It is focused towards two main oncological problems:
 - Thyroid cancer.
 - Treatment of metastasis with P^{32} .
- 9 centers in Cuba are interested (5 hospitals and 4 oncological centers and institutions)



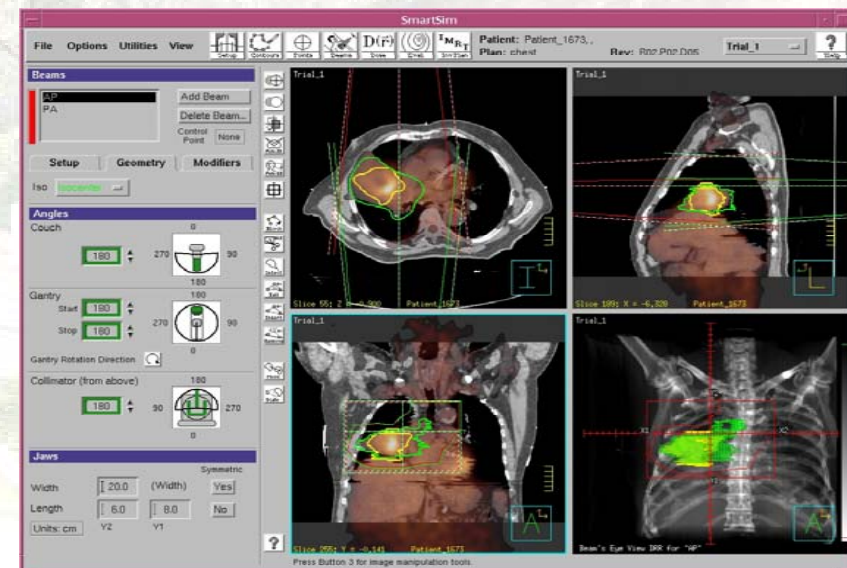
- **Outcome**

- >60 Computing resources have GATE Available

- Gate is Installed on

- tochtli.nucleares.unam.mx
 - ramses.dsic.upv.es
 - grid012.ct.infn.it
 - ce-eela.ic.uff.br
 - ce01.eela.if.ufrj.br
 - ce-eela.ciemat.es

- A demonstration was performed in the frame of the EU-LAC Summit, Lisbon 28-29 April 2006



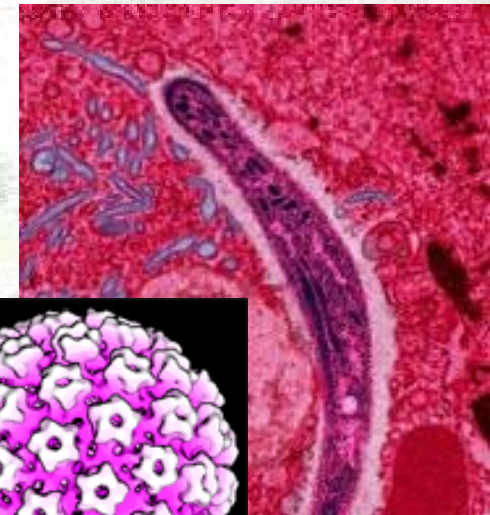
- Due to the lack of network connectivity from/to Cuba a local configuration has been set-up using the EELA stand-alone grid distribution

- **Problem Addressed**

- WISDOM (Wide In-Silico Docking of Malaria) is a deployment of a high-throughput virtual screening platform in the perspective of in-silico drug discovery for neglected diseases
- The in-silico docking is faster and much cheaper than the experimental docking, which is restricted to the most successful ligands obtained after the simulation process

- **LA Interest**

- ULA is leading the interest in the LA
- Collaboration is started in the analysis of new targets for malaria. ULA has selected new targets of Plasmodium Vivax which have been included in large-scale docking experiments

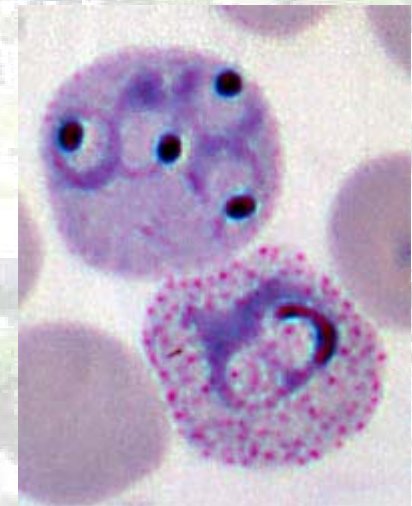




First EELA WISDOM Data Challenge

E-infrastructure shared between Europe and Latin America

- **Outcome:**
 - 2 Targets proposed by ULA
 - DC operated and coordinated by UPV
 - Starting date: October the 23rd, 2006
 - Ending date: January the 1st, 2007
 - Number of original jobs of the first target: 2422. First data challenge experiment on completing all jobs
 - Average computing time per job: 34,4 hours
 - Total effective running time: 228 CPU.days
 - Results obtained: 53 GBytes

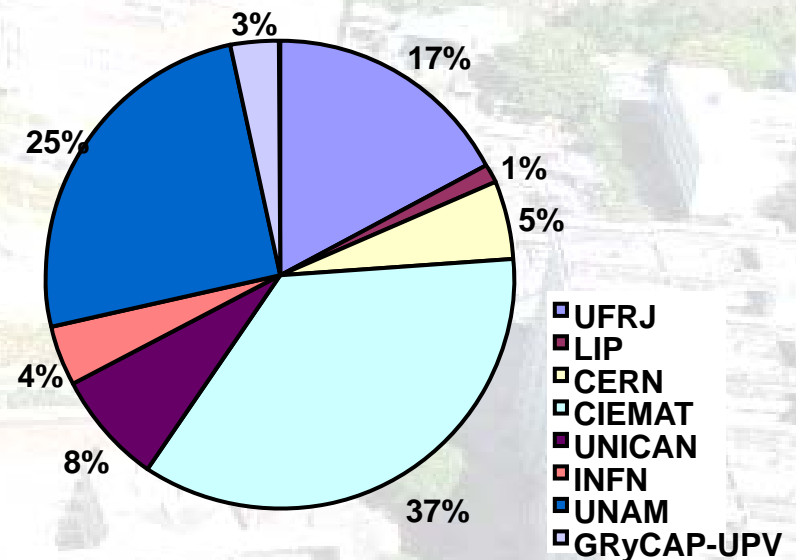
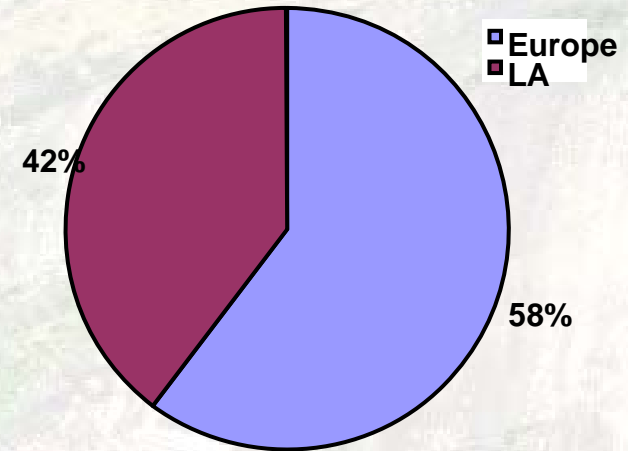




First EELA WISDOM Data Challenge

E-infrastructure shared between Europe and Latin America

- **Sites used:**
 - CIEMAT, Since beginning
 - GRYCAP-UPV, Since beginning
 - INFN , Since beginning
 - UNAM, Since beginning
 - UFRJ, Since beginning
 - UNICAN, LIP and CERN during the DC execution
- **More than 40% of the jobs were effectively executed in LA sites**

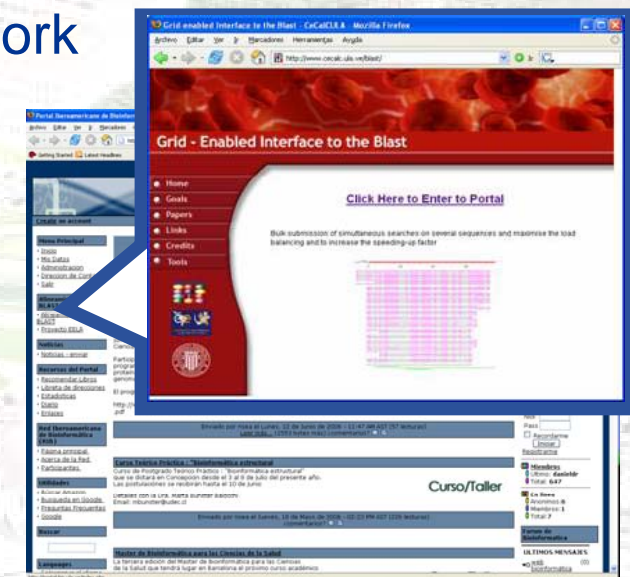


- **Problem addressed**

- BiG: BLAST in Grids is a grid-enabled BLAST interface
- BLAST (Basic Local Alignment Search Tool) is a computationally intensive bioinformatics procedure applied to identify compatible protein and nucleotids sequences in protein and DNA databases
- Applications in drug development, phylogeny, etc.

- **User community**

- The Bioinformatics Ibero-American Network and Portal (<http://portal-bio.ula.ve>)
- This portal also provides several on-line applications for registered users
- It currently has almost 600 registered users from 70 countries (although 90% come from 10 countries)

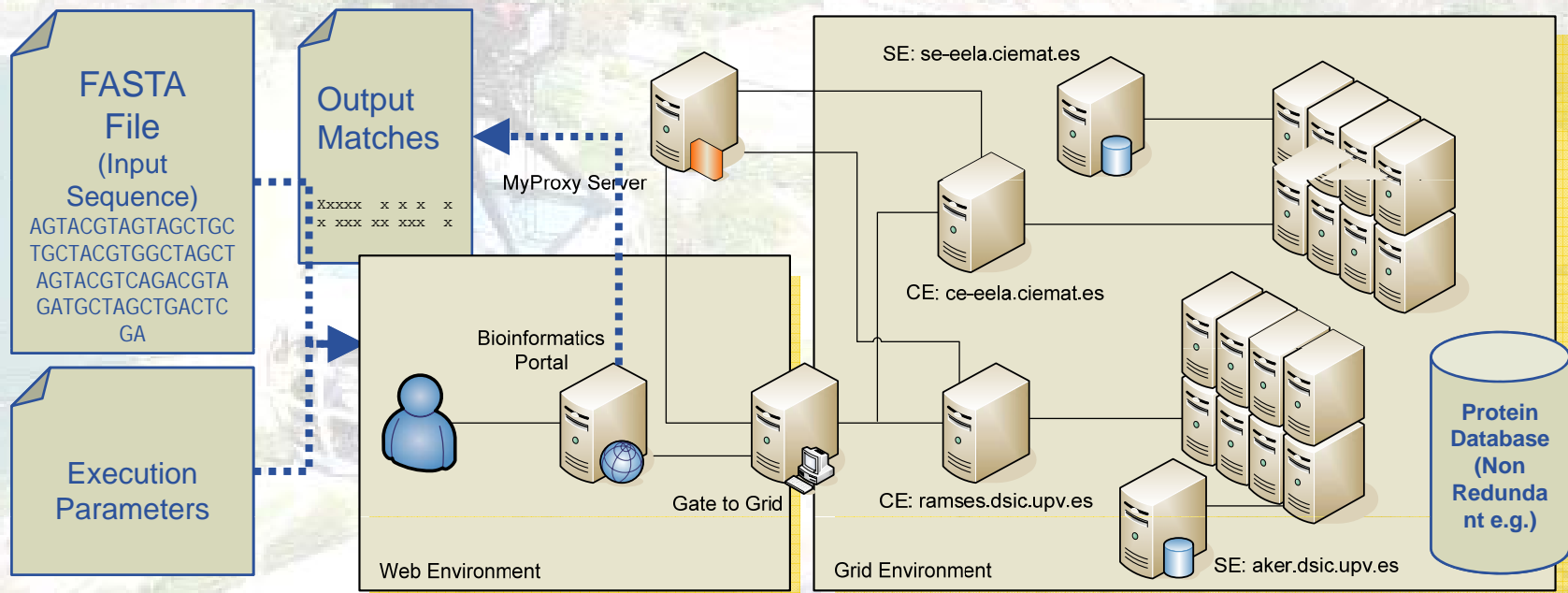




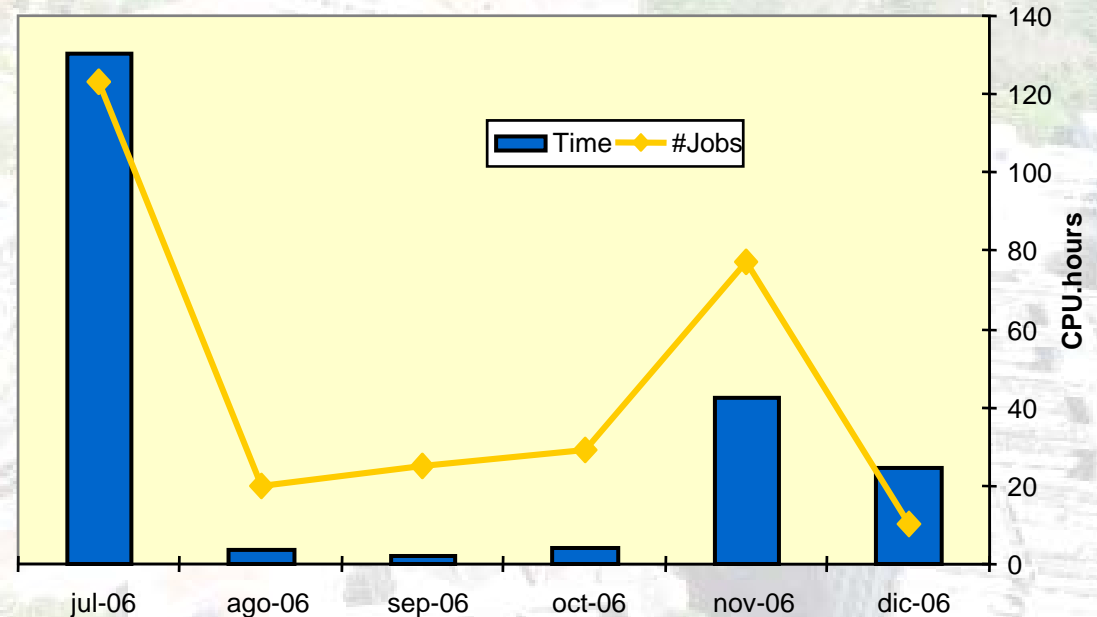
WP3: Task 3.1: Blast in Grids: Approach

E-infrastructure shared between Europe and Latin America

- Use of MPI-Blast kernel
- Enhanced security through a MyProxy server
- Fault tolerant on the client and server side
- Embeddable on a stand-alone application or web portal
- Splitting of input sequences and reference databases into multiple jobs. Deals with multiple databases simultaneously



- **Period: Jul'06-Dec'06.**
- **Usage statistics:**
 - Number of jobs: 284
 - CPU consumed: 173 CPU.days
 - Resources used: ramses.dsic.upv.es 20-CPU queue
 - BiG is being used at the University of Los Andes to work on the complete genome of the Plasmodium Falciparum for the identification of DHFR antigenic proteins



- **Problem addressed**

- A phylogeny is a reconstruction of the evolutionary history of a group of organisms. Very important for the analysis of the resistance to treatments
- Phylogeny tools consume much memory and computing time

- **User community**

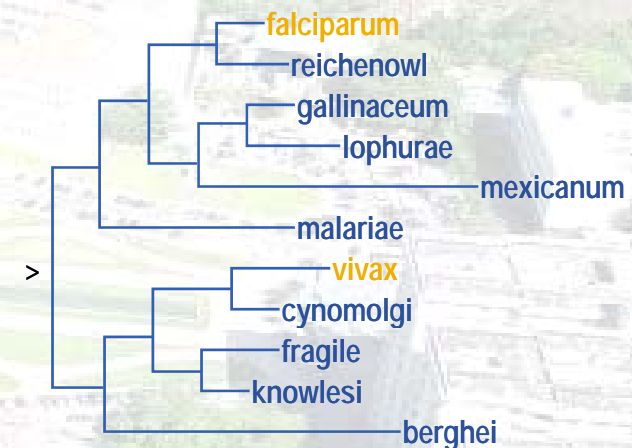
- The Bioinformatics Ibero-American Network and Portal (<http://portal-bio.ula.ve>)

- **Solution proposed**

- Use an mpi-enabled version of a widely used Bayesian inference application for phylogeny (MrBayes)

- **Achievements**

- A grid-service to run parallel MrBayes executions is currently available at UPV



- **HEP and GRID computing**
- **First HEP applications**
 - ALICE experiment
 - LHCb experiment

- **Mature applications**

- ∴ *guaranteed applications*

- **Well supported**

- Developed by LHC collaborations
 - Support available to collaboration members

- **HEP Experiments need GRID computing**

- *All* experiments use grid based computing models
 - HEP communities in Latin America require GRID
 - HEP communities in LA are interested in collaboration with EELA

- **Several EELA partners have HEP groups**

• Applications of interest to EELA partners and other communities in Latin America

– Initial applications

- ALICE experiment: Heavy ion physics at LHC
 - *INFN-Catania, CIEMAT, and UNAM*
- LHCb experiment: B physics at LHC
 - *UFRJ*

– Other LHC applications

- ATLAS experiment (General purpose)
 - *UFRJ, UNLP and UTFSM*
- CMS experiment (General purpose)
 - *CIEMAT; CMS has participants in EELA Brazil and Mexico, but no EELA partner from LA*

– New projects

- Pierre Auger Observatory
 - *INFN-Catania, LIP, UFRJ, UNAM, and UNLP, others in EGEE*



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ALICE experiment in EELA



Usage info

Job parameters				Application software			Details		
Run#	PID	Owner	Events	ROOT	ALIROOT	GEANT	Date	Output dir	
		podesta (15)					last year		
7	1711466	podesta					19.01.2007 03:10	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/007/	test pro
6	1711465	podesta					19.01.2007 03:10	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/006/	test pro
5	1711443	podesta					19.01.2007 03:10	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/005/	test pro
4	1711433	podesta					19.01.2007 03:10	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/004/	test pro
3	1711432	podesta					19.01.2007 03:10	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/003/	test pro
3	1797427	podesta					25.01.2007 20:06	/alice/cern.ch/user/p/podesta/pp_900GeV/03/	MC simu
2	1711421	podesta					19.01.2007 03:10	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/002/	test pro
2	1794911	podesta					25.01.2007 20:06	/alice/cern.ch/user/p/podesta/pp_900GeV/02/	MC simu
1	673395	podesta					06.09.2006 21:08	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/001/	test pro
1	1711410	podesta					19.01.2007 03:10	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/001/	test pro
1	1794908	podesta		v5-13-02	v4-04-Rev-08	v1-6-1	25.01.2007 20:06	/alice/cern.ch/user/p/podesta/pp_900GeV/1/	MC simu
	1769912	podesta					23.01.2007 20:37	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/test/	test eve
	1771607	podesta					23.01.2007 21:36	/alice/cern.ch/user/p/podesta/demo/flow/output_nc/test/	test eve
	1771617	podesta					23.01.2007 21:36	/alice/cern.ch/user/p/podesta/demo/	test eve
	1771691	podesta					23.01.2007 23:39	/alice/cern.ch/user/p/podesta/demo/	test eve
TOTAL : 15 jobs			0						Export folders

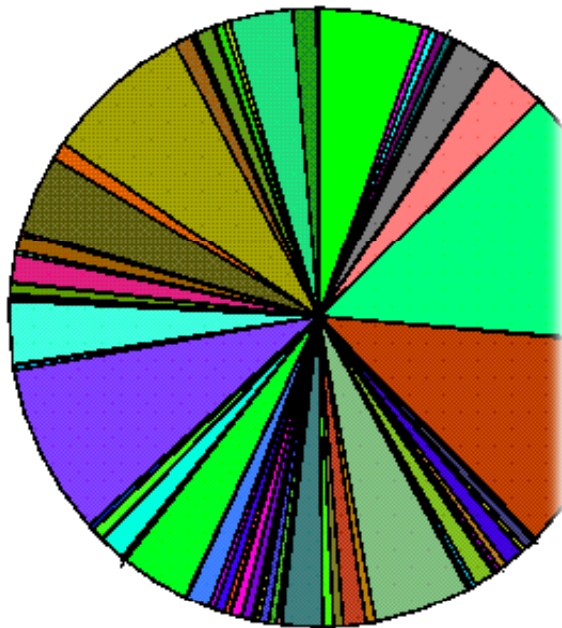
Submission of ALICE Grid jobs from Latin America



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LHCb experiment in EELA

CPU time 15773343 h



DIRAC.LHCBOONLINE.ch	0.00%
DIRAC.Lyon.fr	5.49%
DIRAC.NIPNE.ro	0.00%
DIRAC.UCD.ie	0.00%
DIRAC.Zurich-MH.ch	0.38%
DIRAC.Zurich.ch	0.41%
DIRAC.joel.ch	0.00%
LCG.ACAD.bg	0.47%
LCG.AUVER.fr	0.36%
LCG.BHAM-HEP.uk	0.15%
LCG.BIFI.es	0.11%
LCG.Barcelona.es	2.13%
LCG.Bari.it	0.19%
LCG.Bologna.it	0.01%
LCG.Brunel.uk	2.93%
LCG.CERN.ch	13.67%
LCG.CESGA.es	0.00%
LCG.CGG.fr	0.04%
LCG.CNAF-GRIDIT.it	0.06%
LCG.CNAF.it	11.21%
LCG.CNB.es	0.20%
LCG.CPPM.fr	0.52%
LCG.CSCS.ch	0.26%
LCG.CY01.cy	0.03%
LCG.Cagliari.it	0.00%
LCG.Cambridge.uk	0.00%
LCG.Catania.it	0.01%
LCG.Dortmund.de	0.98%
LCG.Durham.uk	0.40%
LCG.EELA-CIEMAT.es	0.25%
LCG.EELA-UFRJ.br	0.01%
LCG.ETF-RTH.lv	0.11%
LCG.Edinburgh.uk	0.06%
LCG.FESB.hr	0.00%

LCG.FORTH.gr	1.06%
LCG.Ferrara.it	0.02%
LCG.Firenze.it	0.26%
LCG.GOG.sg	0.05%
LCG.GR-01.gr	0.04%
LCG.GR-03.gr	0.07%
LCG.GR-04.gr	0.03%
LCG.GR-05.gr	0.02%
LCG.GRIDKA.de	5.06%
LCG.GRNET.gr	0.50%
LCG.Glasgow.uk	1.17%
LCG.HG-02.gr	0.51%
LCG.HG-04.gr	0.56%
LCG.HG-06.gr	2.13%
LCG.HPC2N.se	0.05%
LCG.HellasGrid.gr	0.19%
LCG.ICI.ro	0.05%
LCG.IHEP.su	0.38%
LCG.IN2P3.fr	0.47%
LCG.INR.ru	0.22%
LCG.IPP.bg	0.06%
LCG.IPSI-IPGP.fr	0.04%
LCG.IRB.hr	0.10%
LCG.ITEP.ru	0.51%
LCG.ITWM.de	0.03%
LCG.Imperial.uk	0.55%
LCG.Iowa.us	0.00%
LCG.JINR.ru	0.09%
LCG.KFKI.hu	0.29%
LCG.KIAE.ru	0.52%
LCG.KIAM.ru	0.31%
LCG.Krakow.pl	1.22%
LCG.LAL.fr	0.08%
LCG.LAPP.fr	0.01%
LCG.LISA.nl	0.00%
LCG.LPC.fr	3.64%
LCG.LPN-fails.fr	0.03%
LCG.LPN.fr	0.19%
LCG.Lancashire.uk	1.34%

LCG.Lancashire.uk	1.34%
LCG.LeSC.uk	0.04%
LCG.Legnaro.it	0.66%
LCG.Liverpool.uk	0.29%
LCG.Manchester.uk	8.93%
LCG.Milano.it	0.24%
LCG.NCP.pk	0.01%
LCG.NCU.tw	0.01%
LCG.NIKHEF-save.nl	0.04%
LCG.NIKHEF.nl	3.28%
LCG.NIPNE.ro	0.13%
LCG.Napoli-Atlas.it	0.07%
LCG.Napoli.it	0.08%
LCG.OU.il	0.06%
LCG.Oxford.uk	0.56%
LCG.PAKGRID.pk	0.00%
LCG.PDC.se	0.06%
LCG.PIC.es	1.43%
LCG.PNPI.ru	0.21%
LCG.Padova.it	0.90%
LCG.Pisa.it	0.20%
LCG.QMUL.uk	4.11%
LCG.RAL-HEP.uk	0.91%
LCG.RAL.uk	7.75%
LCG.RHUL.uk	0.94%
LCG.SARA.nl	0.11%
LCG.SINP.ru	0.16%
LCG.SRCE.hr	0.00%
LCG.Sheffield.uk	0.90%
LCG.Sofia.bg	0.02%
LCG.TAU.il	0.10%
LCG.TCD.ie	0.02%
LCG.Torino.it	0.49%
LCG.UCL-CCC.uk	0.00%
LCG.ULAKBIM.tr	0.32%
LCG.USC.es	3.30%
LCG.WARSAW.pl	1.25%
LCG.WCSS.pl	0.04%
LCG.WEIZMANN.il	0.05%

- **UNLP has recently joined the ATLAS collaboration**
- **UTFSM has started to collaborate with ATLAS**
- **UFRJ ATLAS group expressed interest in using the EELA infrastructure**

- **CIEMAT already resource centre**

- **UNLP and UTFSM are setting up resource**
 - Support ATLAS
 - To be shared with EELA

<http://atlas.web.cern.ch/Atlas/index.html>

- **CMS is the only LHC experiment without participation from a Latin American EELA partner**
- **CMS groups in EELA member countries**
 - Brazil
 - Mexico
 - Spain (CIEMAT)
- **First contacts established**
 - Presentation at the 1st EELA conference
 - Brazilian and Mexican CMS groups participated in the network survey

<http://cms.cern.ch/>



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Pierre Auger Observatory

- **Four EELA partners (more collaborators in EGEE)**
 - INFN-Catania
 - LIP
 - UFRJ
 - UNAM
 - UNLP
- **Start GRID use in 2007**

<http://www.auger.org/>

Task 3.3: Additional Applications

Task responsible for new applications (dynamic!)

- e-Learning
- Climate



– 8 Partners/ 6 Countries (1 EU and 5 LA):

- CEDERJ (Brazil)
- CIEMAT (Spain) active
- CUBAENERGIA (Cuba)
- SENAMHI (Peru)
- UniCan (Spain)
- UDEC (Chile)
- UFRJ (Brazil)
- UNAM (Mexico)



- What is it?
 - *Use of multimedia technology to develop and improve new learning strategies*
- Characteristics
 - *Data stored under the control of a Learning Management System (LMS)*
 - *Contents can be updated and exchanged with other systems*

- **Why e-learning on a grid?**
 - Limitations of current systems
 - Scalability
 - Storage capacity
 - Availability
 - Computing power
 - Lack of some kinds of interactive capabilities
 - Good side-effects:
 - Automatic data location (video, text, equipments, etc.)
 - Confidentiality
 - Extraction of relevant information, not only location
 - Data standardization



WP3: Task 3.3: e-Learning Applications

E-infrastructure shared between Europe and Latin America

- CEDERJ, UFRJ, CIEMAT → VoD
- CUBAENERGIA → CuGfL
- UNAM → LEMDist



Sites of the CS course

- 16 Regional sites
- 3 Regional satellite sites
- ◆ 5 call centers at UERJ, UFRJ, UNIRIO, UFF and UENF
- 3 places dedicated to Science

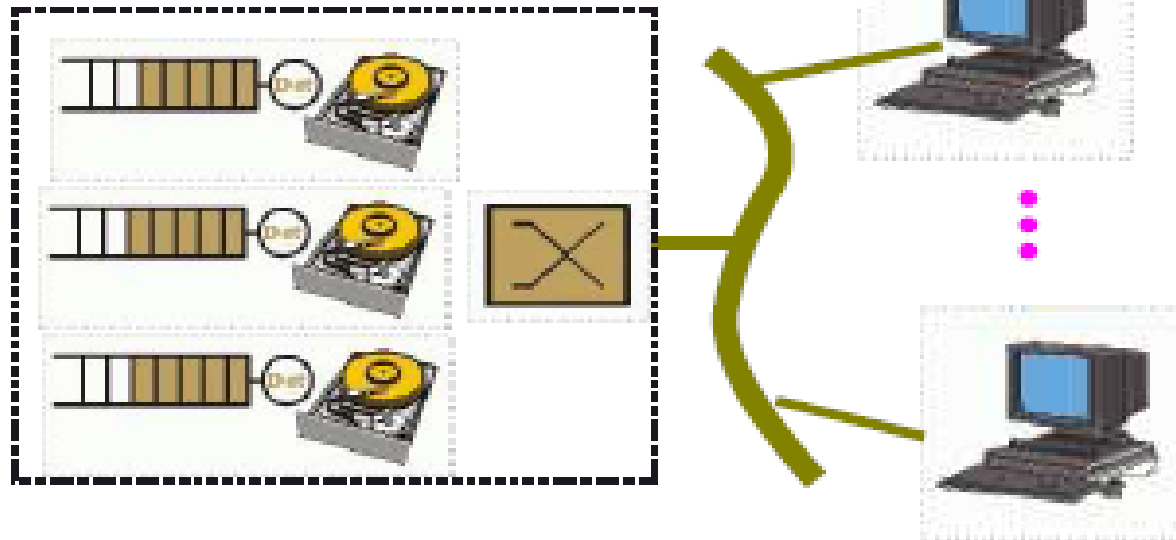
New sites (Feb 2006)



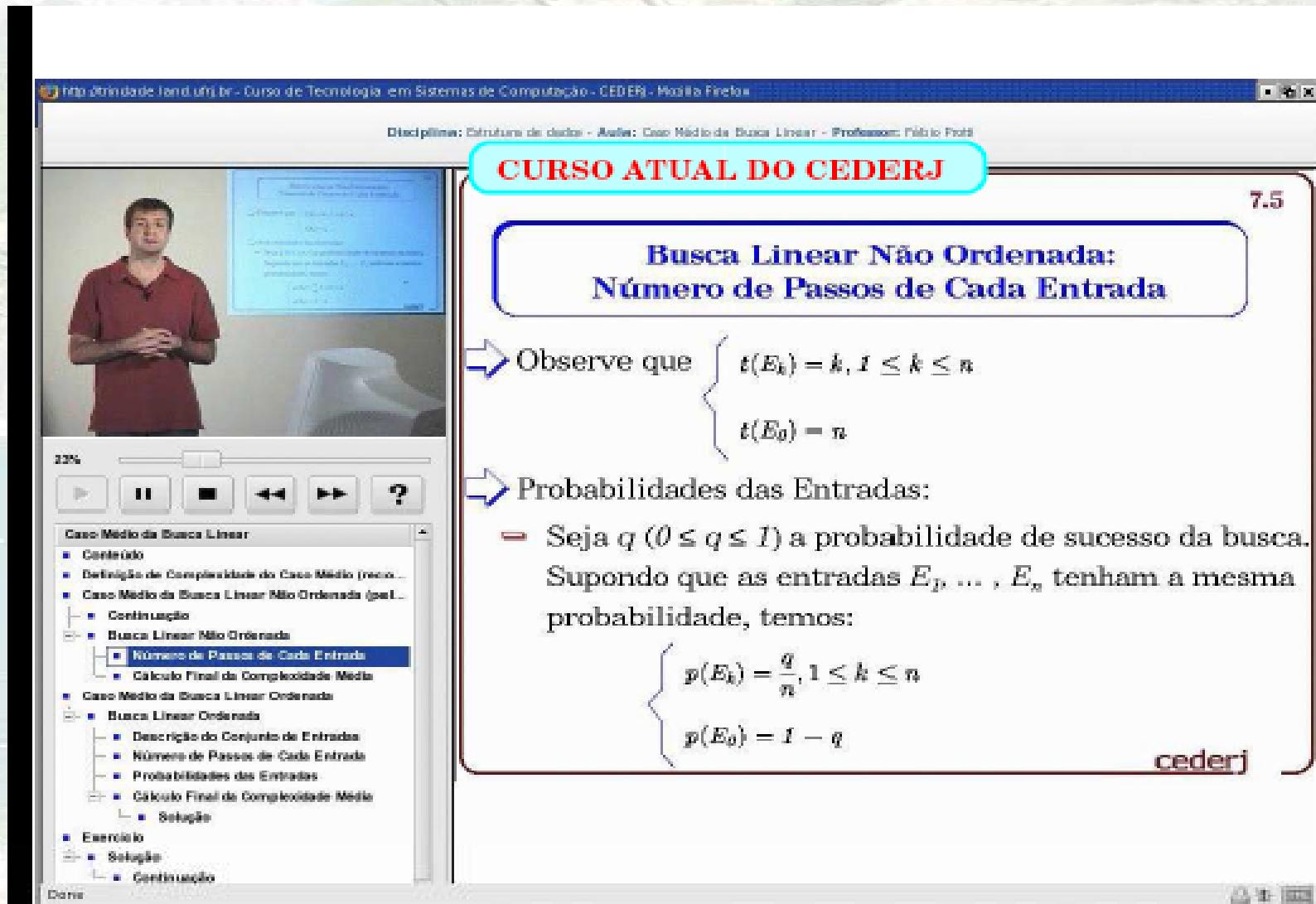
Map of Rio de Janeiro state



Multimedia Server



Computer Lab



http://bridade.land.uff.br - Curso de Tecnologia em Sistemas de Computação - CEDERJ - Modalidade Presencial

Disciplina: Estrutura de dados - Asseto: Caso Médio da Busca Linear - Professor: Fábio Proff

CURSO ATUAL DO CEDERJ

7.5

Busca Linear Não Ordenada: Número de Passos de Cada Entrada

⇒ Observe que
$$\begin{cases} t(E_k) = k, 1 \leq k \leq n \\ t(E_0) = n \end{cases}$$

⇒ Probabilidades das Entradas:

= Seja q ($0 \leq q \leq 1$) a probabilidade de sucesso da busca. Supondo que as entradas E_1, \dots, E_n tenham a mesma probabilidade, temos:

$$\begin{cases} p(E_k) = \frac{q}{n}, 1 \leq k \leq n \\ p(E_0) = 1 - q \end{cases}$$

cederj

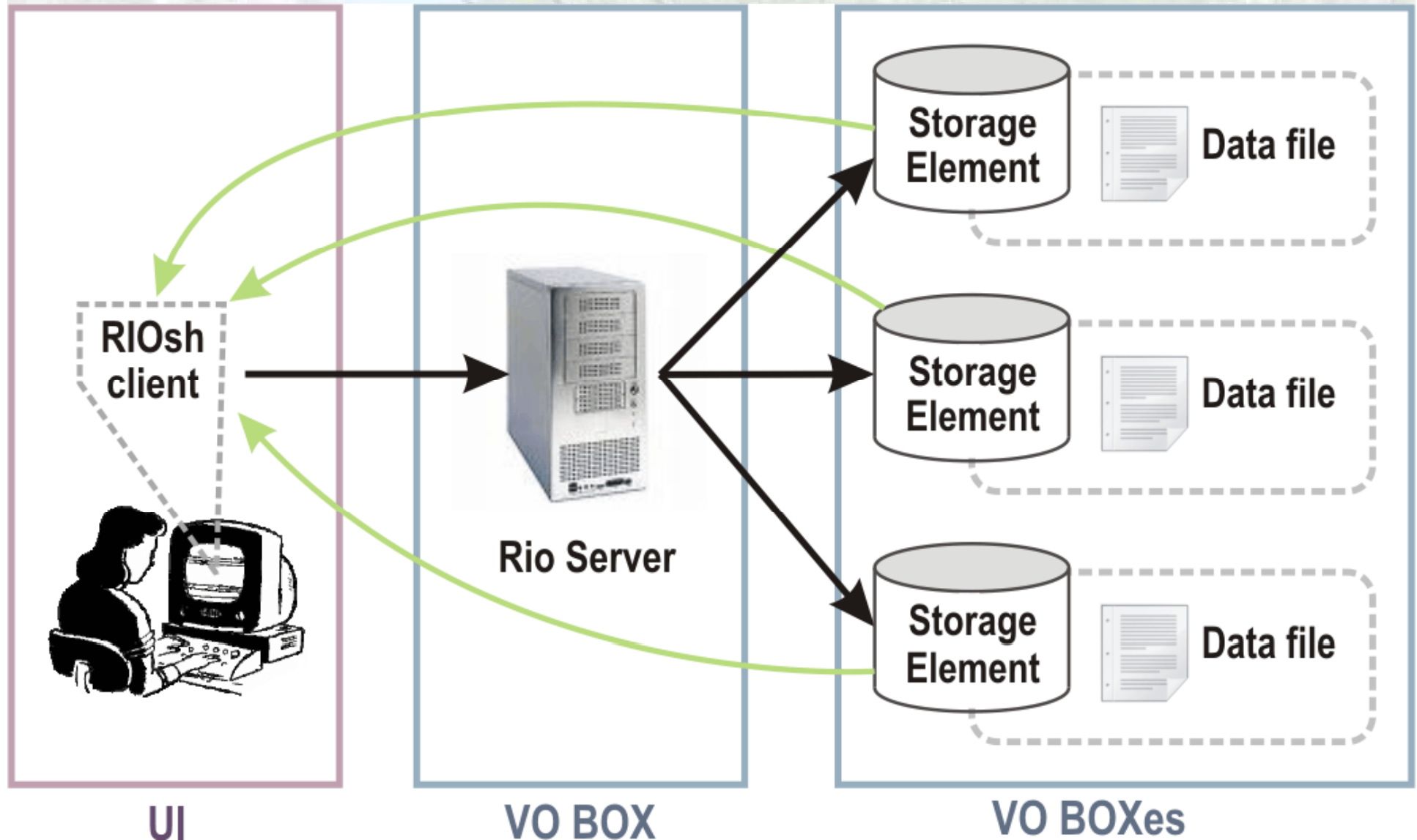
23%

Caso Médio da Busca Linear

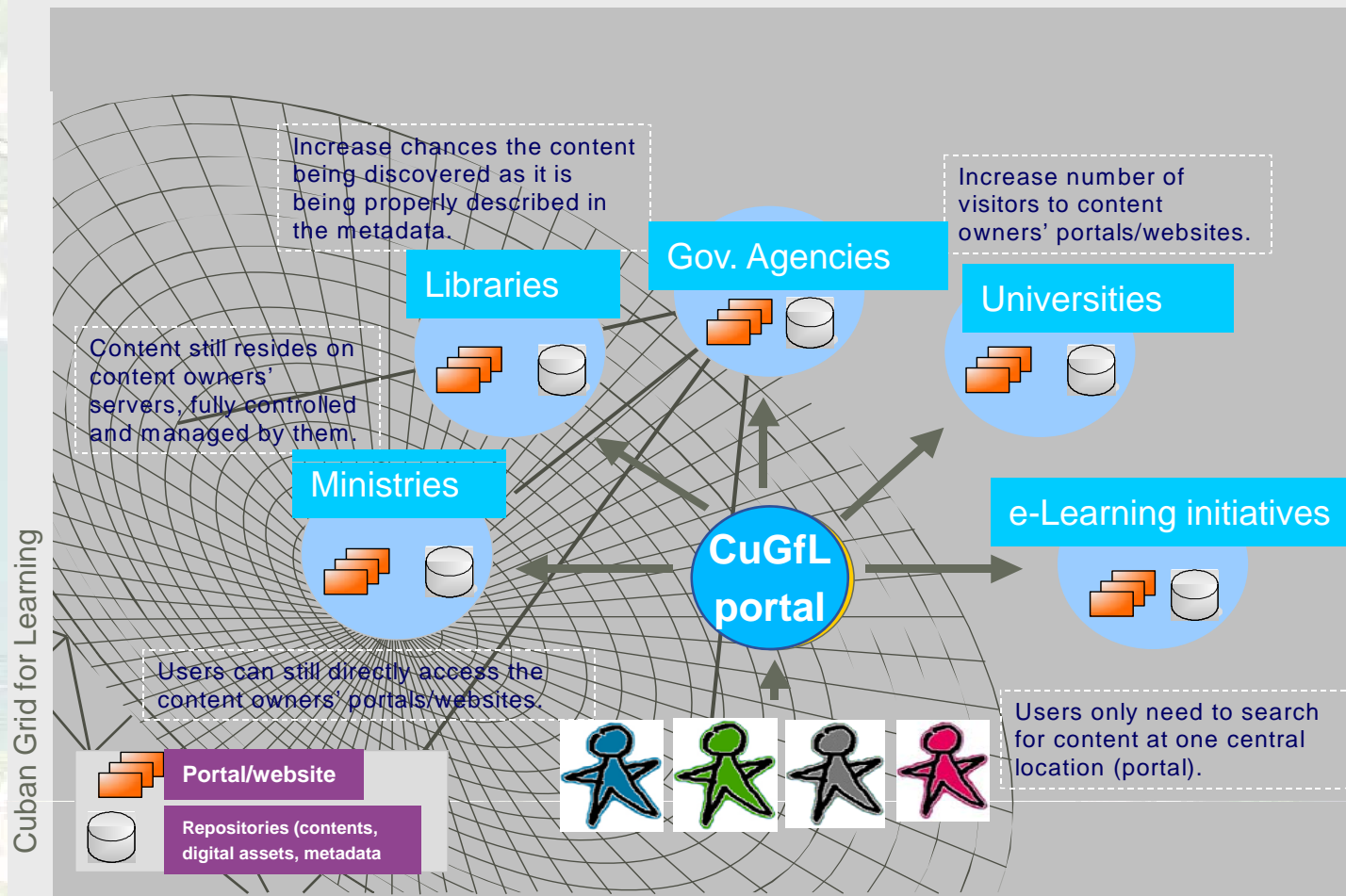
- Conteúdo
- Definição de Complexidade do Caso Médio (meio...)
- Caso Médio da Busca Linear Não Ordenada (pel...
 - Continuação
 - Busca Linear Não Ordenada
 - Número de Passos de Cada Entrada**
 - Cálculo Final da Complexidade Média
- Caso Médio da Busca Linear Ordenada
 - Busca Linear Ordenada
 - Descrição do Conjunto de Entradas
 - Número de Passos de Cada Entrada
 - Probabilidades das Entradas
 - Cálculo Final da Complexidade Média
 - Solução
- Exercício
 - Solução
 - Continuação

Done

- **First prototype version to the EELA infrastructure during the 1st EELA Grid School (EGRIS-1)**
- **Client requests come from User Interfaces (UIs)**
- **Videos and data are stored on Storage Elements**
- **RIO server installed on entry points of the EELA infrastructure**

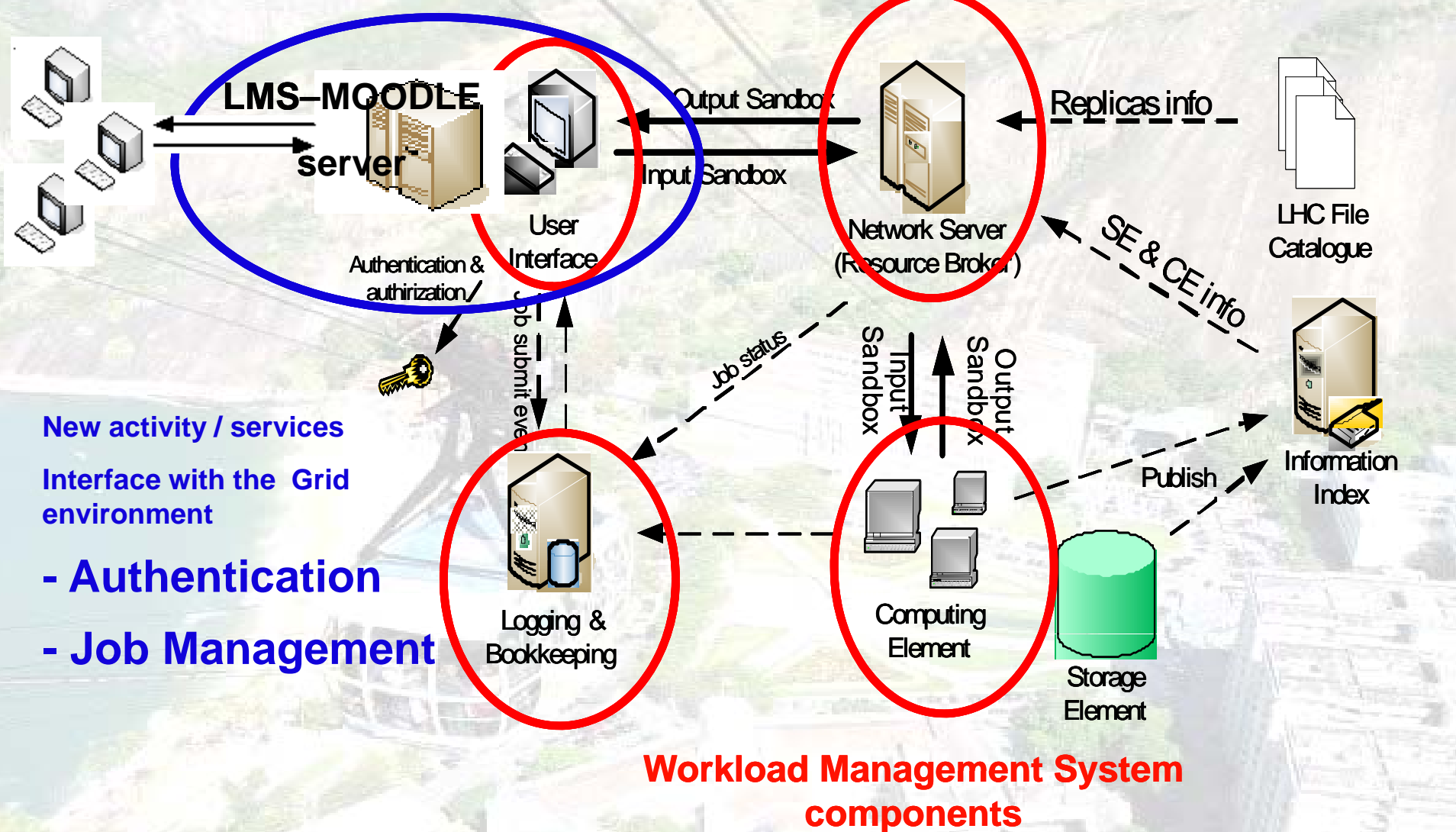


Cuban Grid for Learning (CuGfL) (CUBAENERGIA)



- Based on Moodle**
- Course management system to produce web-based courses that support a social constructionist framework of education**
- Implemented:**
 - Job Management Module**
 - Authentication Module**

LMS MOODLE - Architecture overview



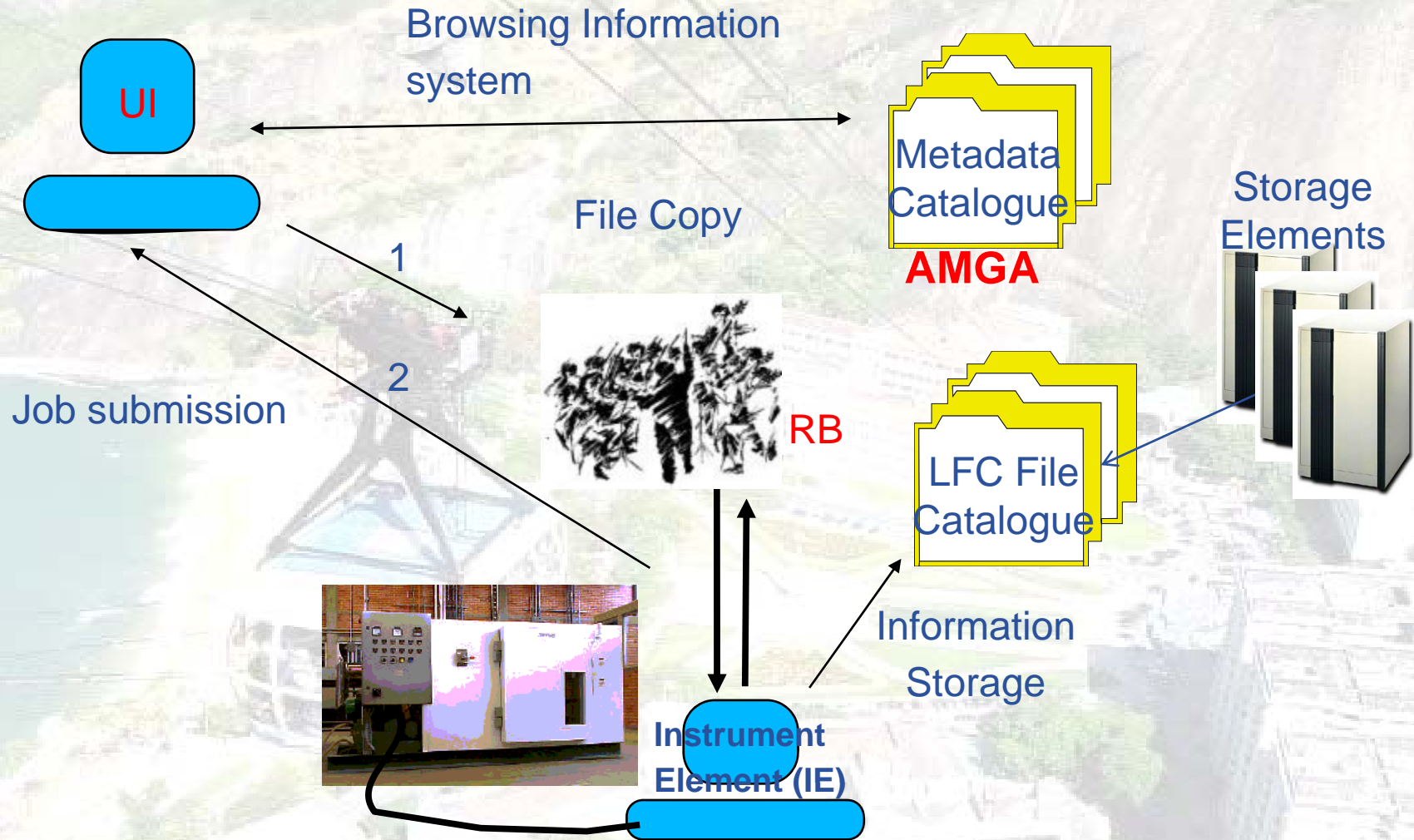
New activity / services

Interface with the Grid environment

- Authentication
- Job Management

Workload Management System components

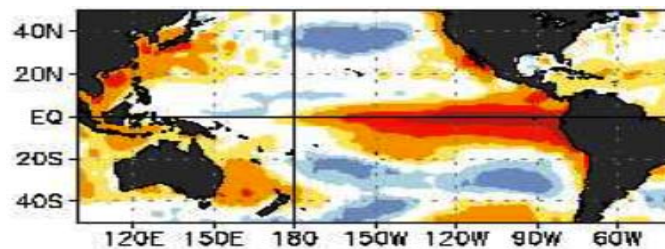
Laboratorio Experimental Multidisciplinario a Distancia



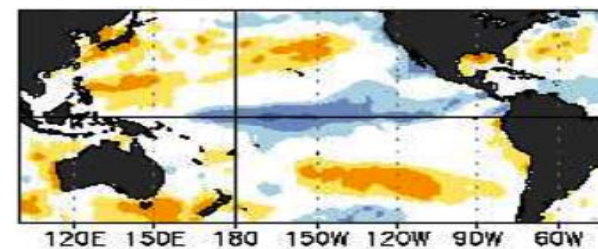
- **Goal: Predict Local Impacts of “El Niño” in Latin America**

A challenging problem for the climate community, with **huge** socio-economical impact in Latin America.

Anomalous heating



Anomalous cooling



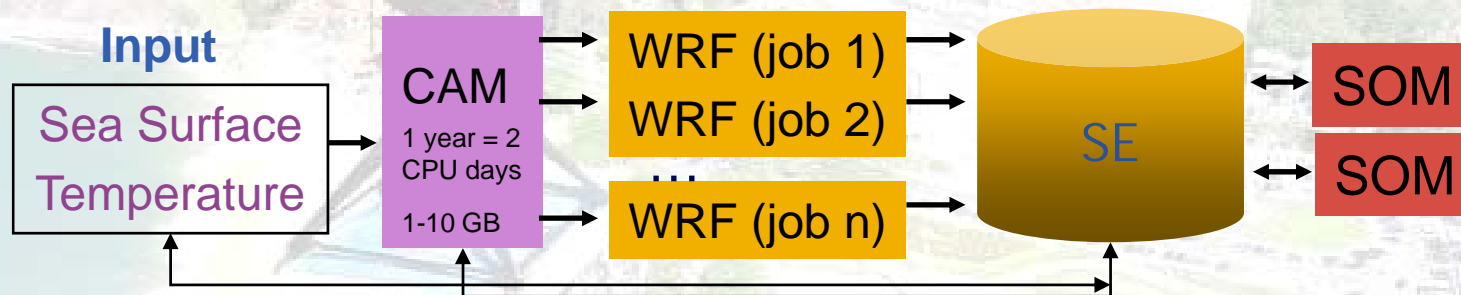
- **GRID helps to** share computing resources, heterogeneous data, as well as know-how in a user-friendly form.
- **A new integrated climate application** developed in EELA from the scratch, with no similar counterpart in any other Earth Science/Climate EU Project.

Three applications have been identified (climate sequence):

- Global atmospheric circulation model (**CAM**) **Deployed !**
- Regional weather model (**WRF**) **Deployed !**
- Datamining clustering tools (**SOM**) **Work in progress**

This sequence poses several computational challenges

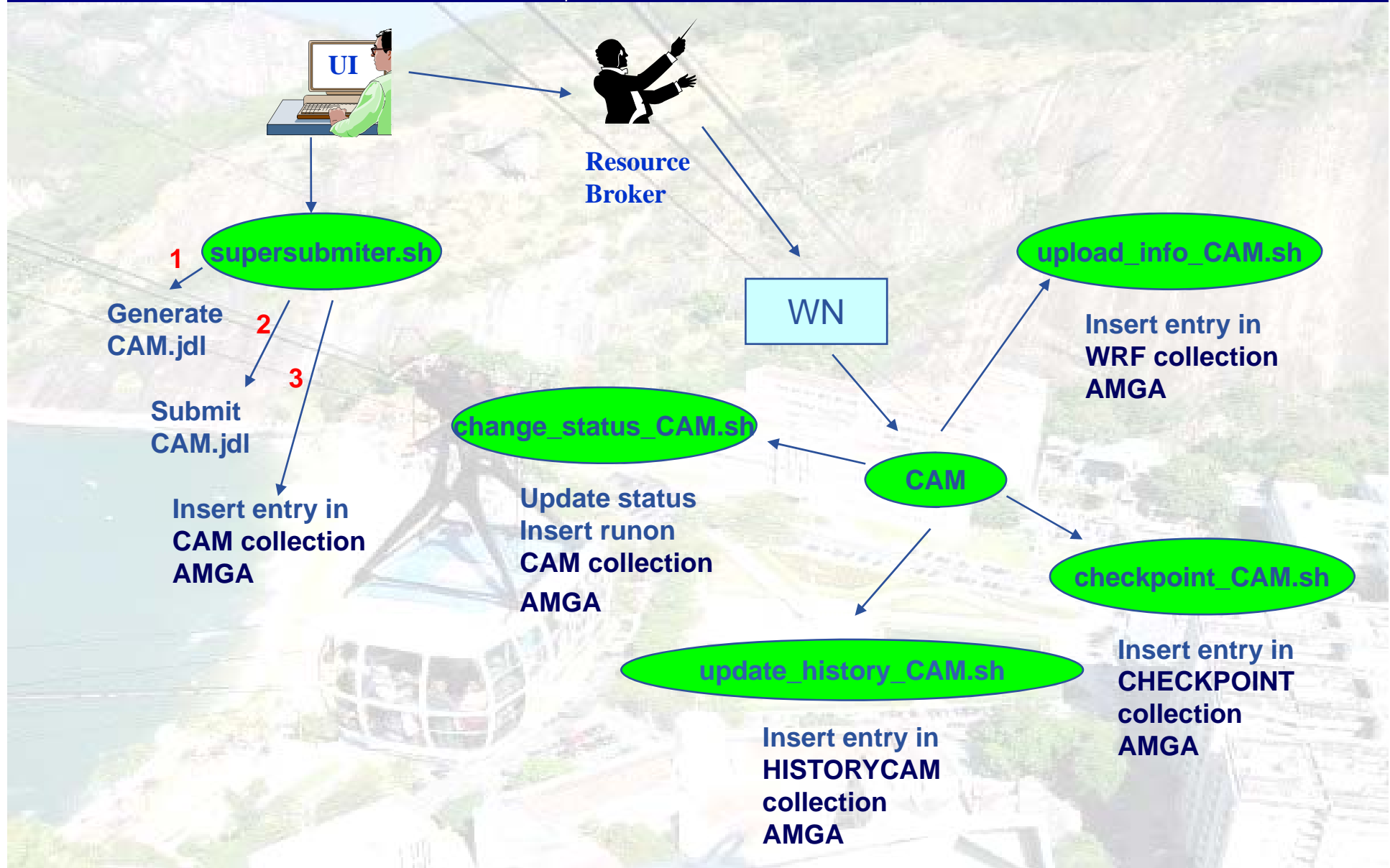
Nontrivial dependent relationships among the applications.



This sequence of jobs demands middleware solutions for:

- Preparing and submitting dependent jobs / data sharing (workflow).
- Restarting interrupted experiments.
- Manage metadata (for datasets and application status).

Application Workflow



- Using GENIUS to interact with the applications (CAM+WRF)
- In the future a climate specific portal will be developed (JSR168) to run and track scientific experiments.

The screenshot displays the GENIUS Grid Portal interface. On the left, a navigation menu includes 'CAM' and 'WRF' sections. The main content area features a 'WRF JOBS STATE' table with the following data:

caseid	status	Start Time	jobID
Peru3	Running	2007-02-22 16:10:39	https://rb-eela.ciem
Peru2	Aborted	2007-02-22 16:07:36	https://rb-eela.ciem
Peru	Done(Success)	2007-02-22 15:48:07	https://rb-eela.ciem
concepcion	Done(Success)	2007-02-22 11:28:31	https://rb-eela.ciem
ConcepcionFloodings	Done(Success)	2007-02-22 11:09:54	https://rb-eela.ciem
kyrill_GB2	Done(Success)	2007-02-22 10:01:30	https://rb-eela.ciem

Below the table, a climate plot titled 'Plot de nino97.cam2.h0.1997-10-25-00000.nc' is shown, displaying a global map with a color scale from 0 to 900. The plot shows a significant area of high values (red/yellow) in the central Pacific Ocean, characteristic of an El Niño event.

For the near future, but established through 2006

- Increase and support the user communities
- Survey of new communities
 - MoU with more Projects
- 12 New applications interested in joining EELA





E-infrastructure shared between Europe and Latin America

New communities

**EELA has setup a procedure to
accept new associated partners
and their applications**

http://www.eu-eela.org/eela_mou.php

EGRIS-1

EMBOSS (UNAM → MoU)

SegHidro (UFCG → MoU)

**Distributed Simulation of Multiple
Failure Events on Optical Networks
(UNESP, UNICAMP, USP)**



VOLCANO SONIFICATIONS (EGEE-INFN)

SATyrus (UFRJ)

PILP (UFRJ)

- **Great achievements after the 1st EELA Grid School in Itacuruçá with EELA and non-EELA applications successfully ported to gLite**
- **More synergy and interaction among all partners**
- **People are very much involved in making the EELA infrastructure a success**
- **All of these apps will have a tremendous impact on LA**





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Useful information

WP3 web page:

http://www.eu-eela.org/eela_wp3.php

WP3 documents:

<http://documents.eu-eela.org>

Forthcoming Events:

- **3rd EELA Conference: December 3-5, 2007**
- **Second EELA Grid School, EGRIS-2**



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Thank you!!!

Any questions?