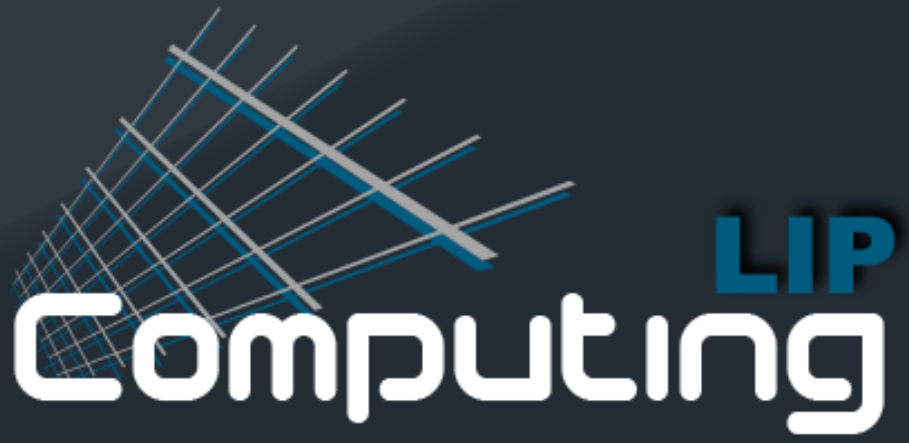


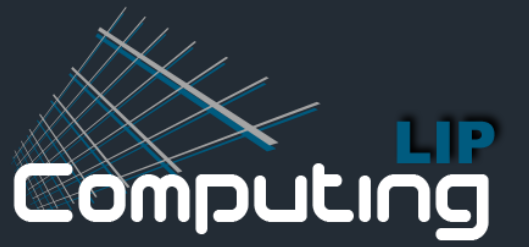
LIP Computing Activities

LIP workshop 2012

Overview

IT services & infrastructures

e-Science & WLCG



"LIP computing activities"

By Jorge Gomes

Computing @ LIP

- Activities
  - Information Technology services
    - IT infrastructure, computing and network services
    - Supporting daily research activities
  - Research and development
    - Computer science is also a research line

- Group
  - Team of 10 persons
  - Mix of engineers, technicians and PhDs
  - Extensive experience in e-Science, advanced computing and distributed computing
  - Boosted by grid computing R&D activities on distributed data processing for the LHC experiments

IT services

- Enabling the LIP research activities and participation in international scientific collaborations

  - The largest scientific computing infrastructure in the country
    - Two LIP computer centres in Lisbon and Coimbra
    - Main grid node in partnership with FCCN and LNEC
    - For internal users, HEP experiments and other user communities

  - Provisioning of services
    - Management of computing equipment and networks
    - Standard and advanced IT services for the LIP community
    - Support helpdesk for LIP users
    - Also support for e-Science activities

IT physical infrastructure


LIP Coimbra


LIP Lisbon

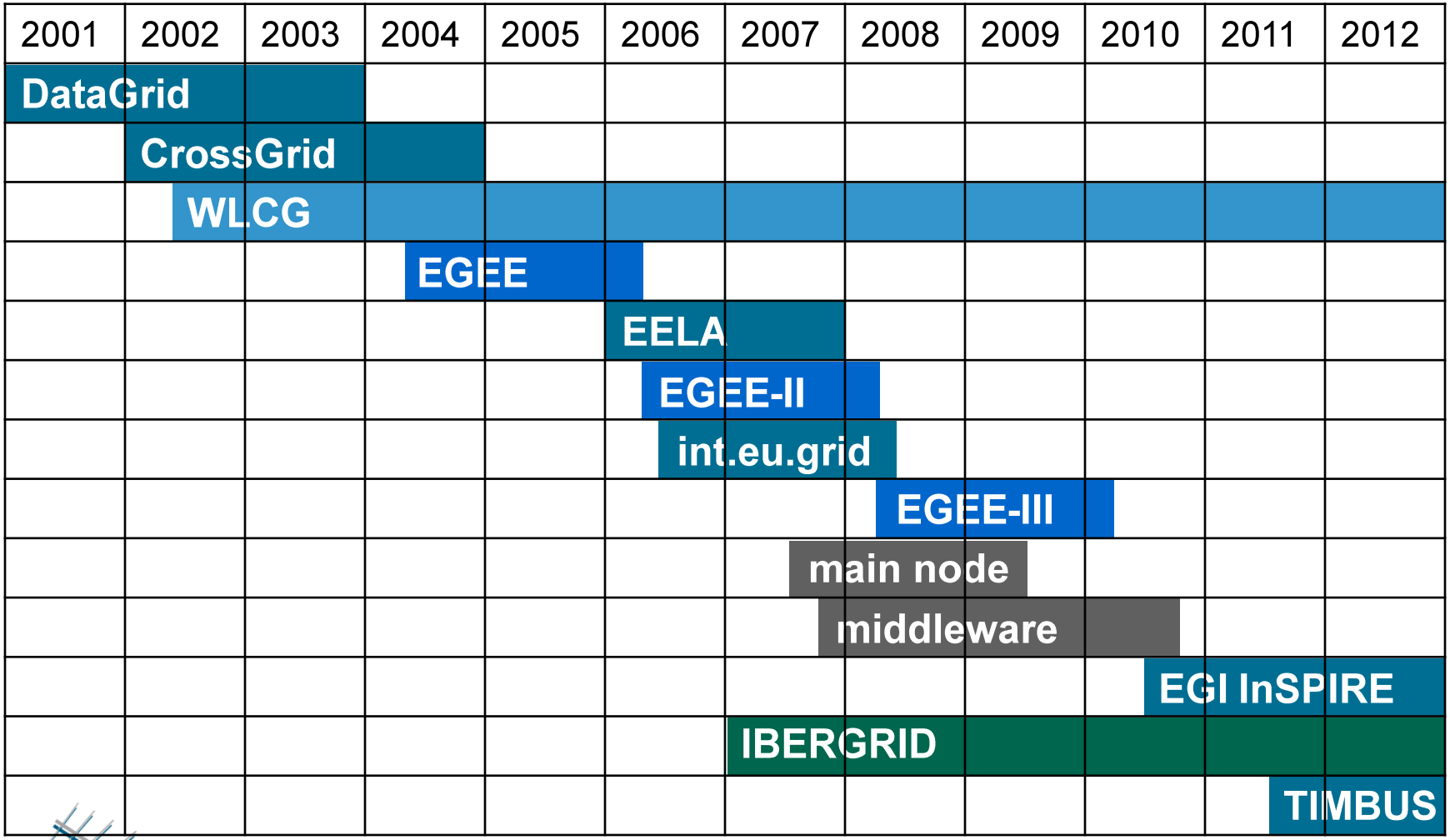

NCG (LNEC)

Complex distributed infrastructure

- > 1900 CPU cores
- > 240 worker nodes
- > 42 TB or RAM

- > 340 servers
- > 110 disk arrays
- > 1400 disks in arrays

Projects and Initiatives



Portuguese WLCG Tier-2

WLCG:

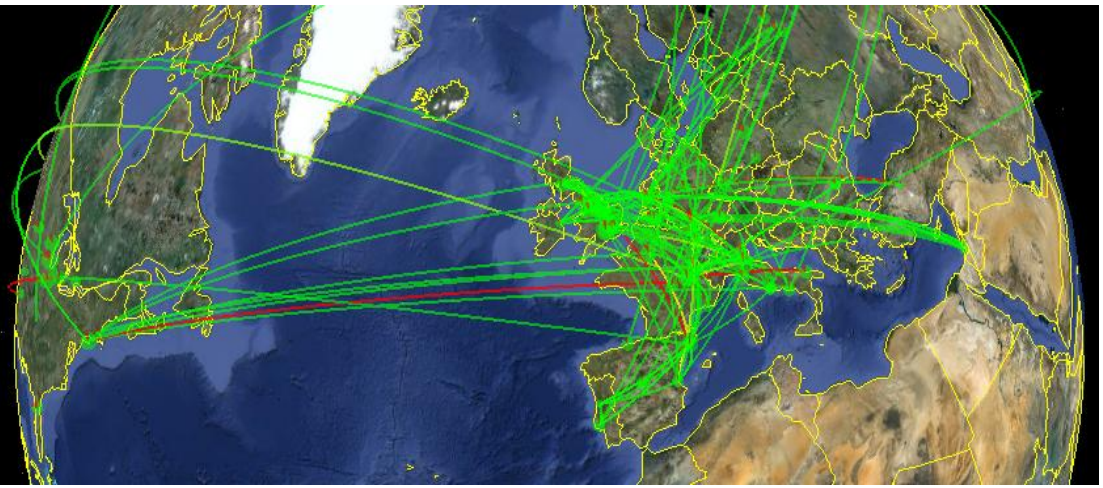
36 countries

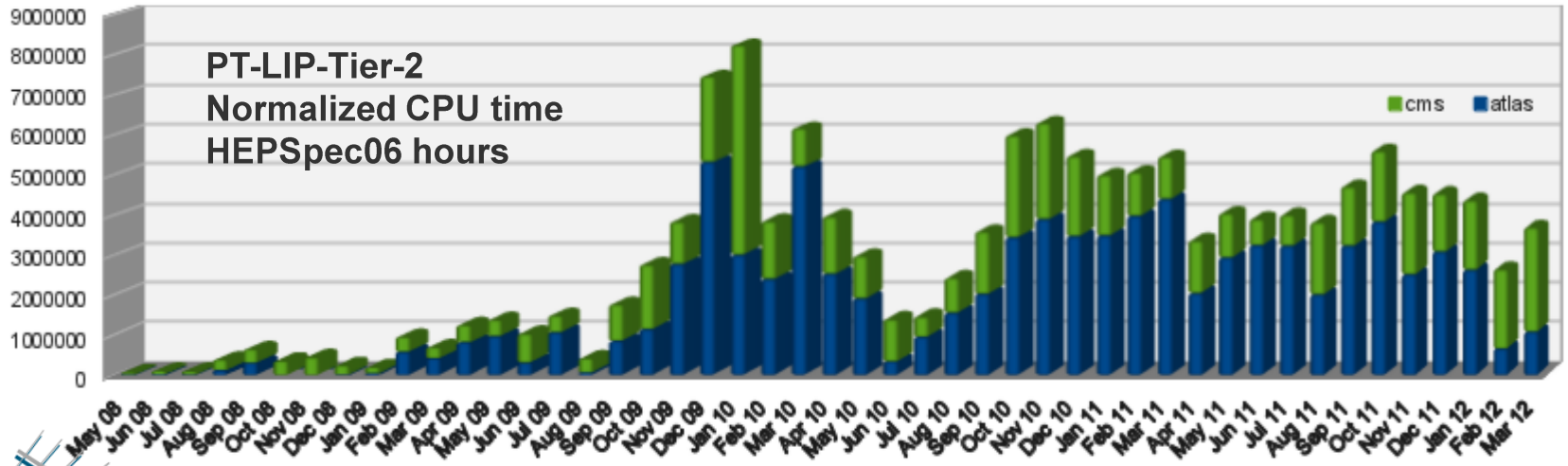
170 datacentres

LIP federated Tier-2

12th worldwide T2

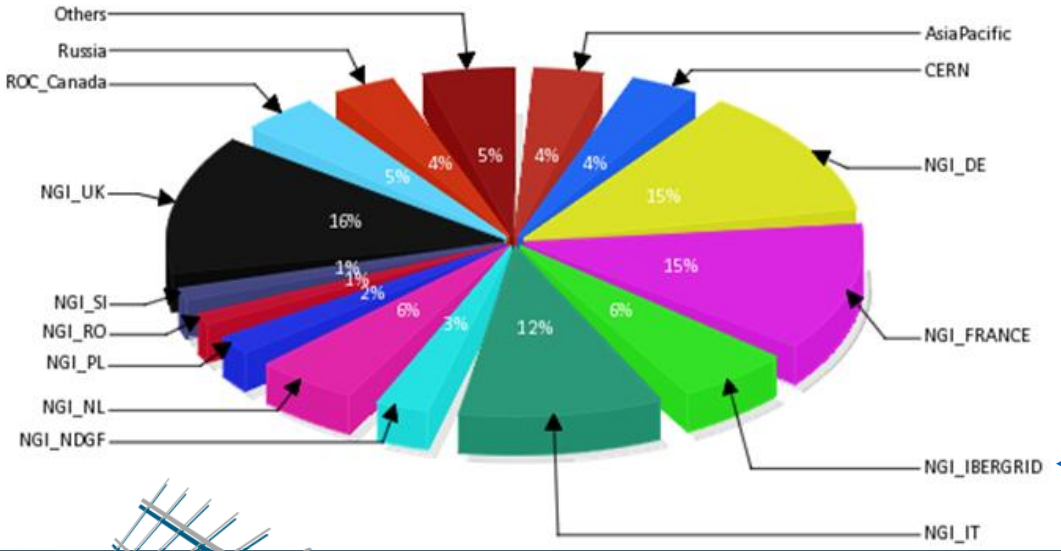
9th European T2

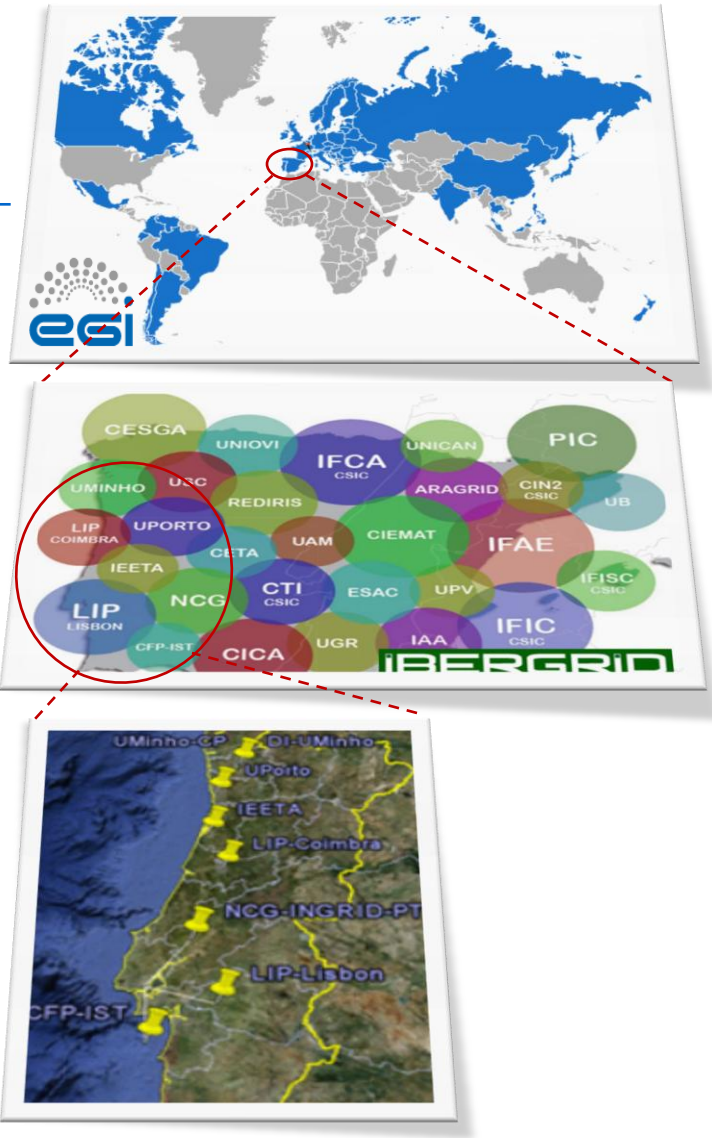




e-Science

- Supporting multiple scientific domains
  - Biomed, chemistry, oceanography, fusion…
- Leading edge grid infrastructures
- Integrating computing resources
- Infrastructure coordination
- User and site support



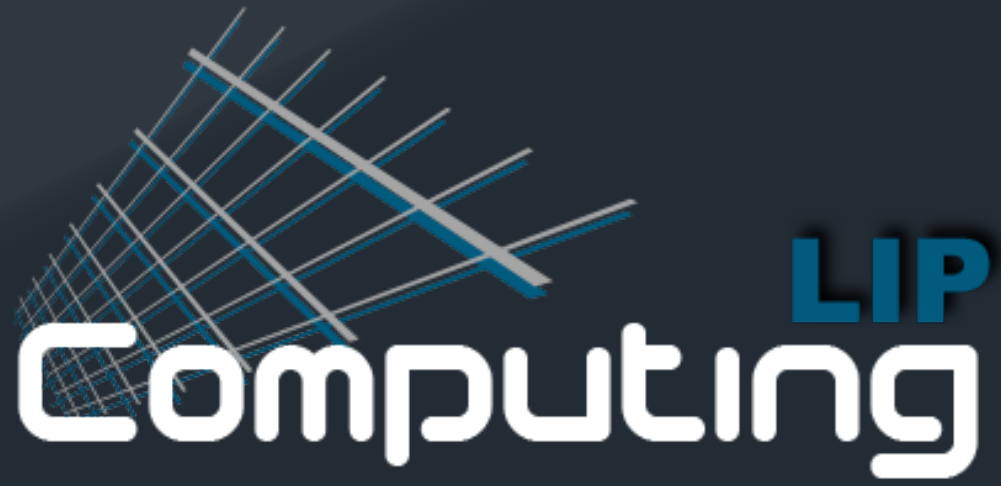


LIP Computing

"LIP Computing Activities"

OVERVIEW

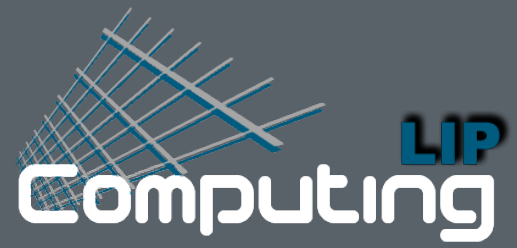
By Jorge Gomes



LIP Computing Activities

IT Infrastructure

Web and other services

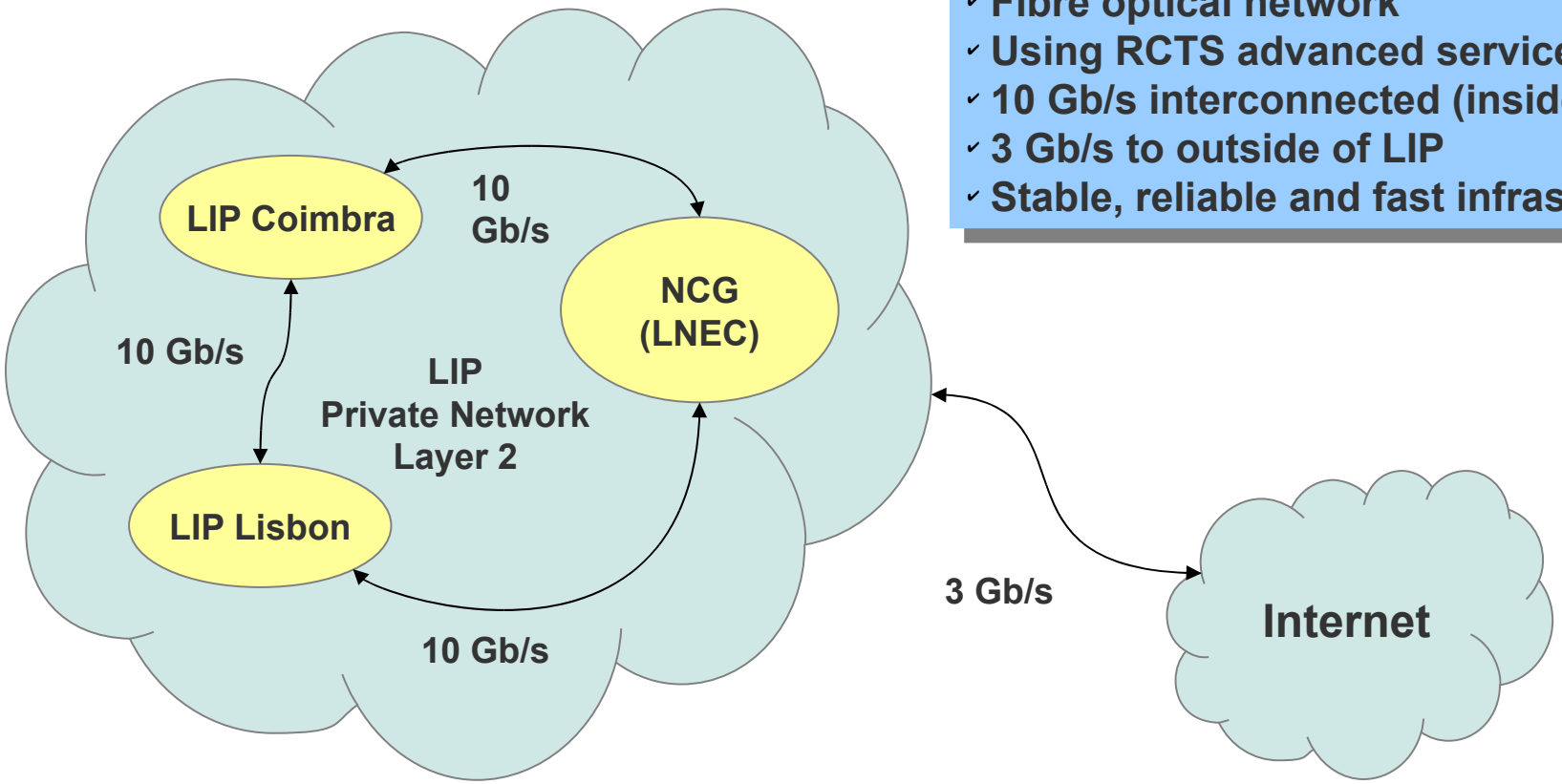


"LIP computing activities"

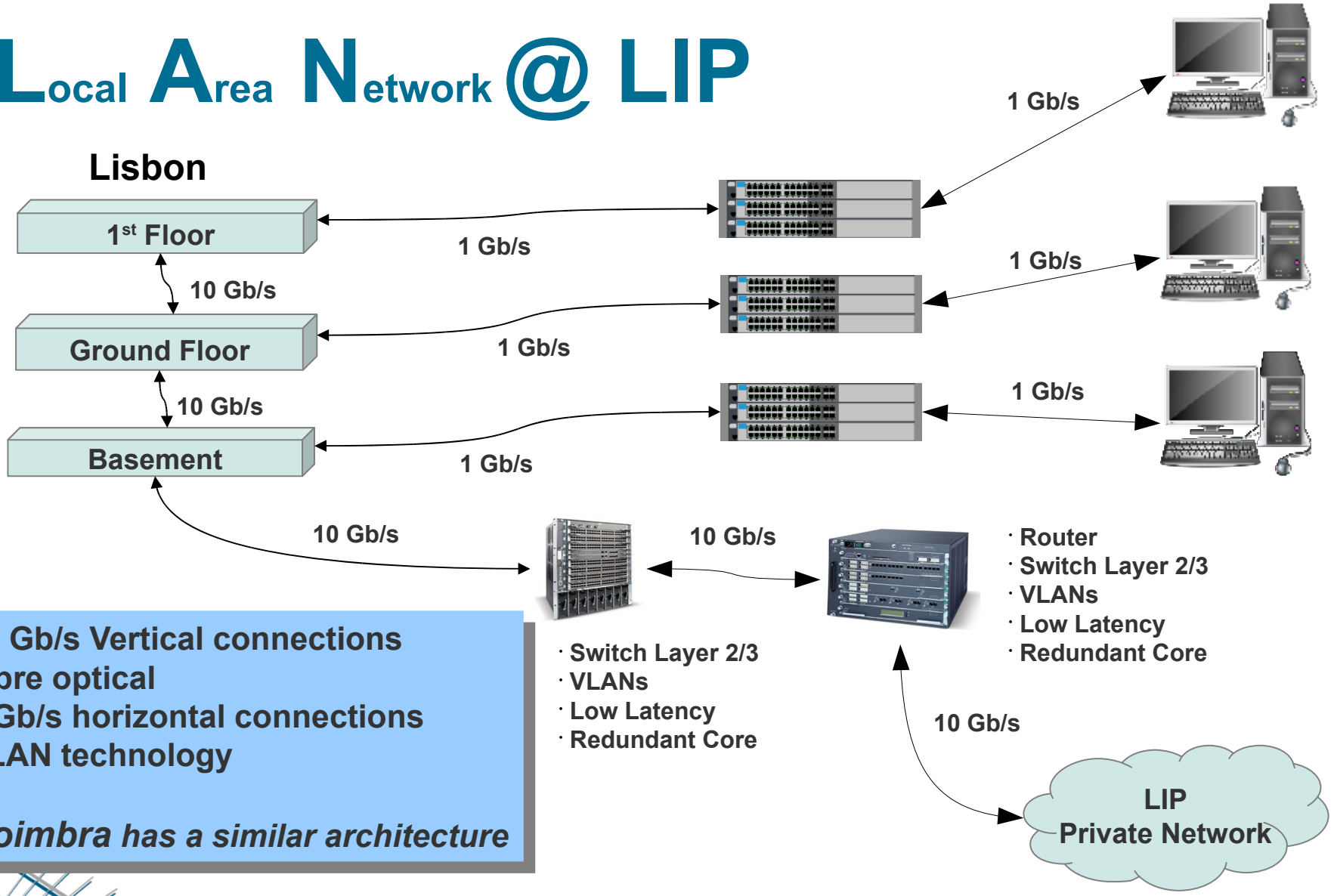
By Nuno Dias

Wide Area Network @ LIP

- Managing 3 network centres
- Fibre optical network
- Using RCTS advanced services
- 10 Gb/s interconnected (inside Layer 2)
- 3 Gb/s to outside of LIP
- Stable, reliable and fast infrastructure



Local Area Network @ LIP



- 10 Gb/s Vertical connections
- Fibre optical
- 1 Gb/s horizontal connections
- VLAN technology

- *Coimbra has a similar architecture*

Wireless @ LIP

Lisbon

LIP-WLAN-2
LIP-WLAN-5

Standard b/g/n
150 Mb/s (Max)

LIP internal wireless network

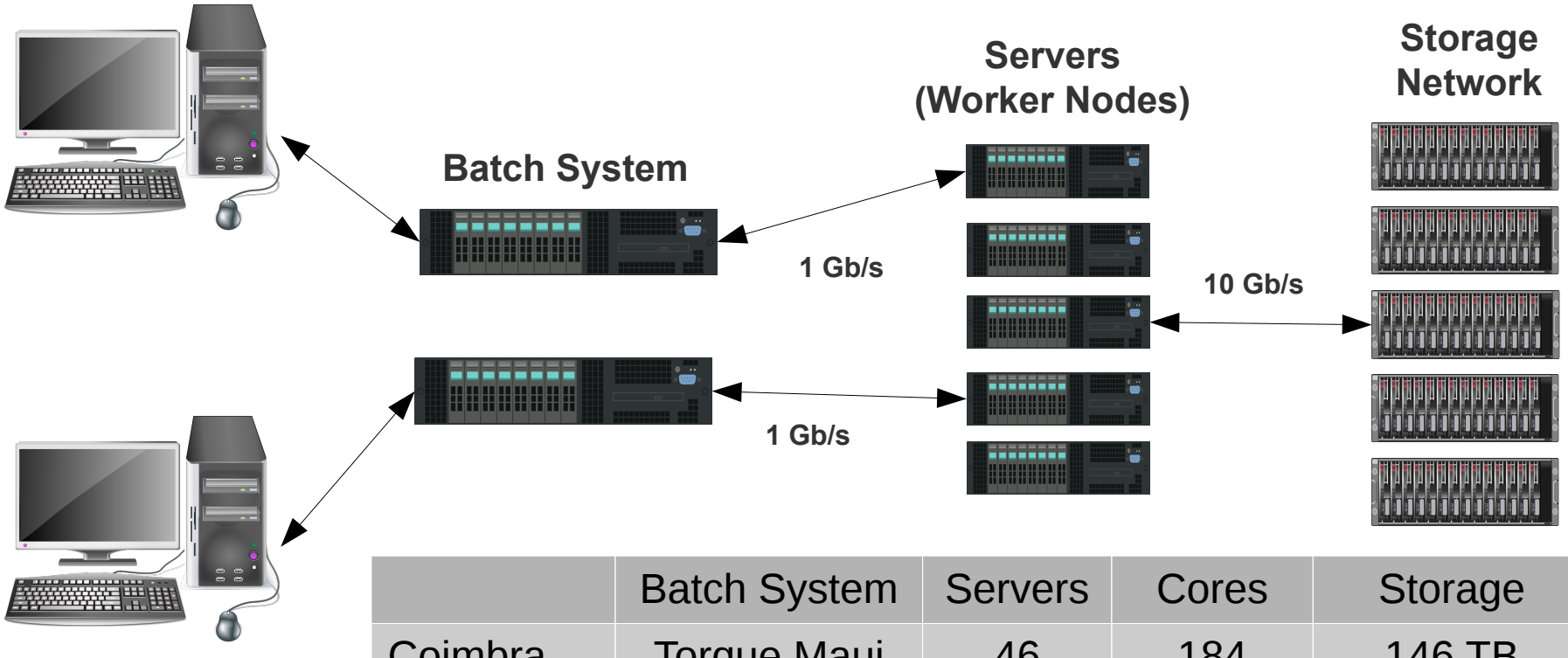
- Provides connection to internal LIP Lisbon network

Eduroam

- Supported since one year ago
- Worldwide network for users in roaming
- LIP issues eduroam credentials (Lisbon and Coimbra)
- Upgrade of technology
- New hardware

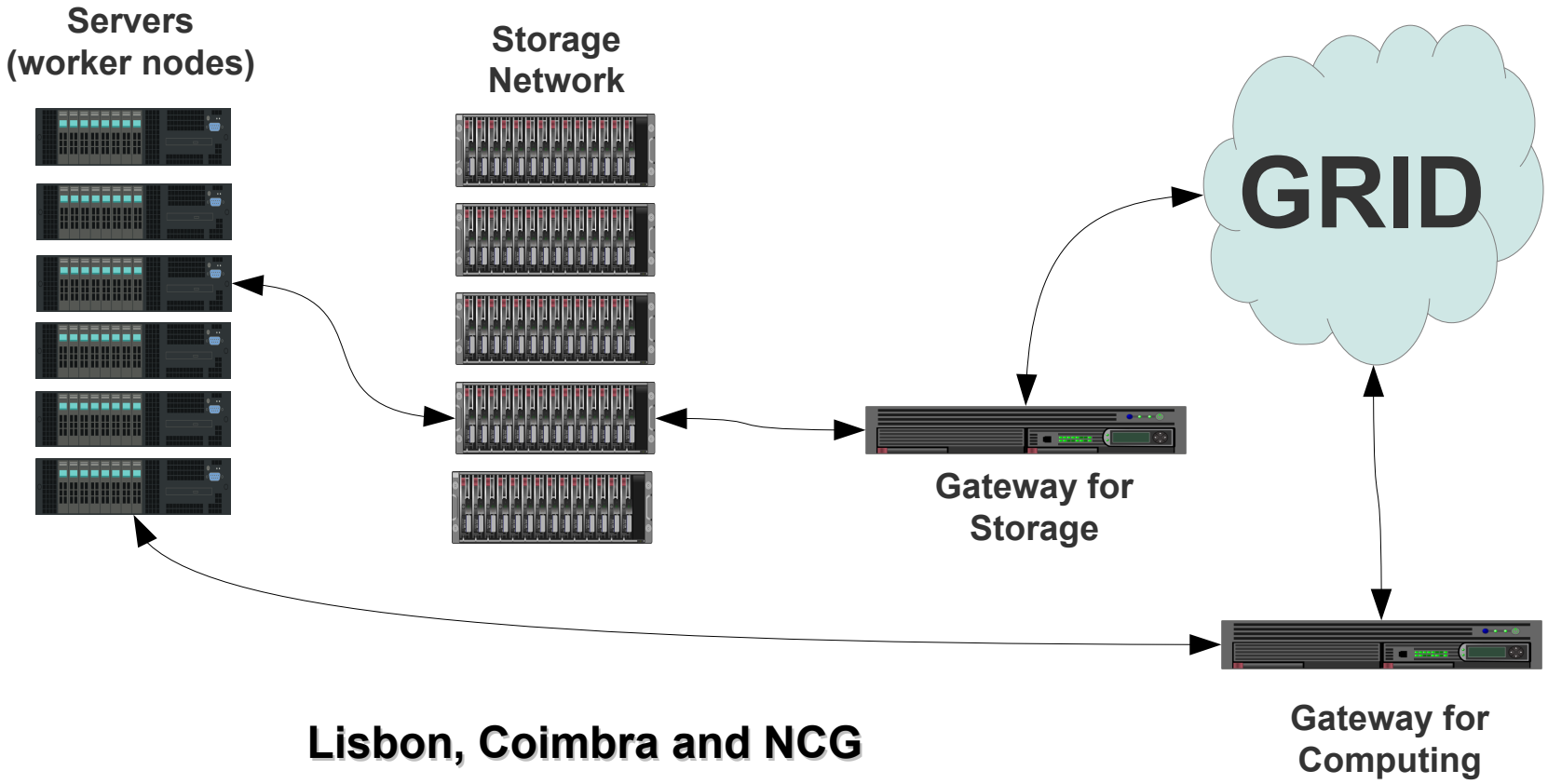
Farm @ LIP

- A set of WNs controlled by a batch system
- Used by local users and GRID

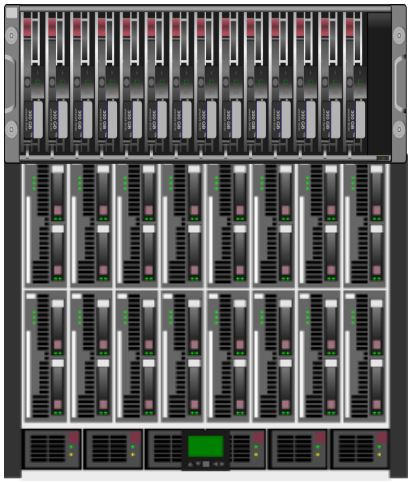


	Batch System	Servers	Cores	Storage
Coimbra	Torque Maui	46	184	146 TB
Lisbon	Grid Engine	139	532	310 TB

GRID @ LIP


Servers
(worker nodes)
Storage
Network
GRID
Gateway for
Storage
Gateway for
Computing
Lisbon, Coimbra and NCG

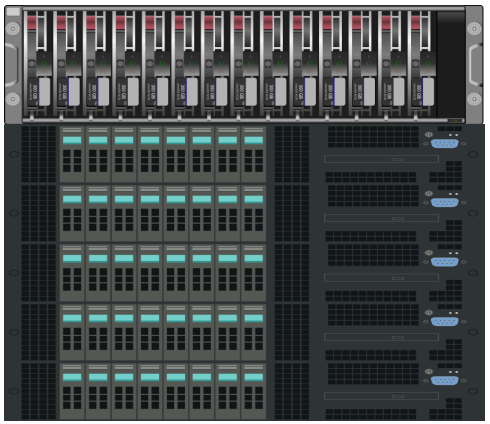
HPC + Medusa @ NCG



Storage 11 TB

216 Cores

- 2 Blade Centres
- Low latency
- Interconnected with Infiniband



Storage 12.8 TB

248 Cores

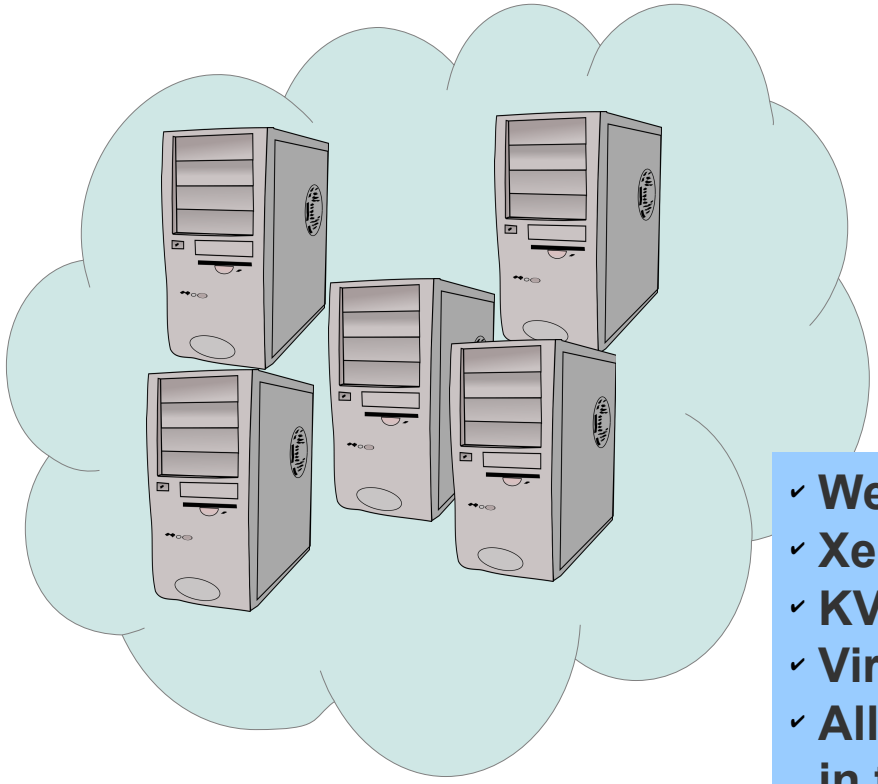
High Performance Computing (HPC)

- Fully dedicated to parallel jobs
- Service to the Portuguese Scientific Community

Cluster LNEC (Medusa)

- Managed by LIP (NCG Centre agreement)
- Connected to the LIP Private Network

Virtualization @ LIP



- We use extensively VMs to provide services
- Xen technology used at the beginning
- KVM techonlogy are used now
- Virtualization platform
- Allows running multiple machines in the same hardware
- Optimization of resources
- Easy migration of machines

Backups @ LIP

- Amanda backup system

- TAPE Library
- 302 tapes
- LTO4 (800 GB)
- ~242 TB (Not enough to backup all the data in storage)

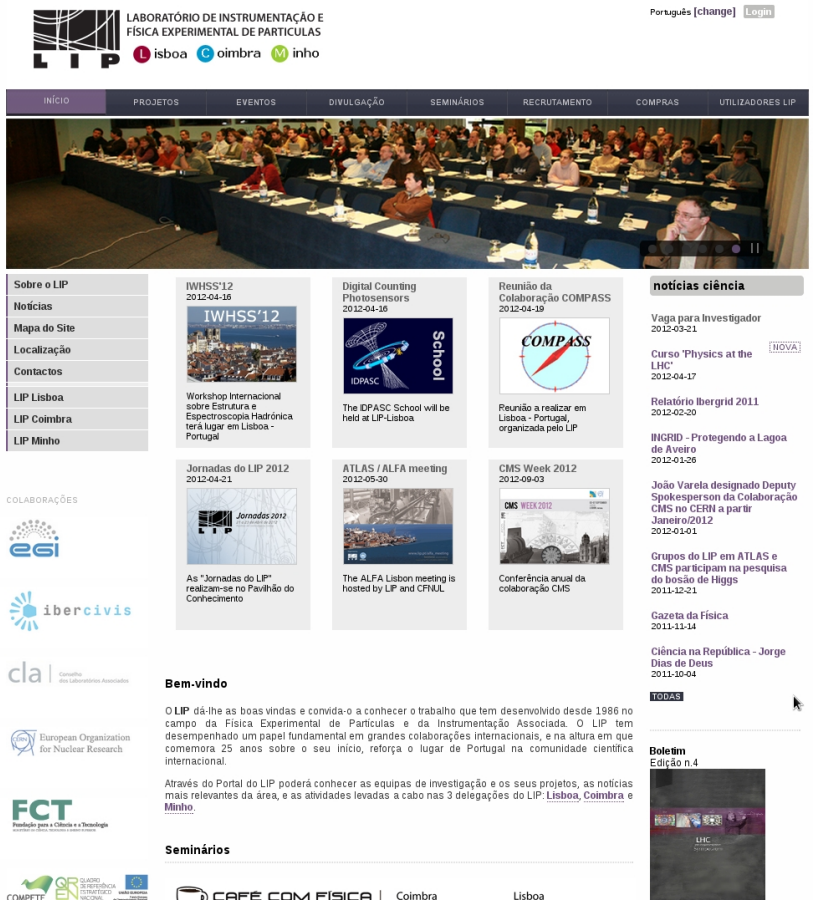
- Mail
- Homes
- Webpages
- Databases

- Data
- /lustre (not everything)

Improvements

- Since March 2011: Implementation of a “greener CC” at LIP Lisbon
  - Automatic shutdown of idle machines
  - Automatic shutdown of desktop machines
  - Decommissioning of old and inefficient hardware, both computing and storage.
  - Tuning of air conditioning
  - Implementation of cold and hot corridors in the Datacentre
  - Power factor correction

World Wide Web @ LIP



- LIP web pages were consolidated
- New public image on the 25th anniversary of LIP
- LIP Computing fully administrate all the web pages (Coimbra, Lisboa and Minho).
- Visual identity for the web
- Content management system

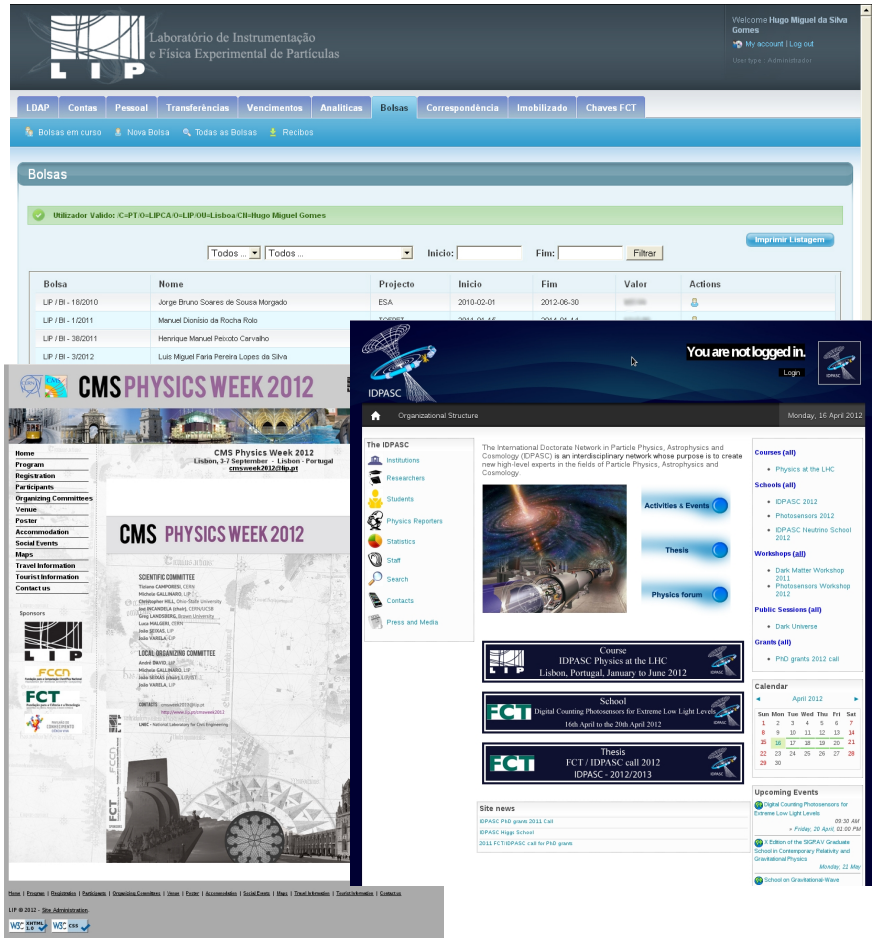
LIP Computing

"LIP computing activities"

IT INFRASTRUCTURE

By Nuno Dias

World Wide Web @ LIP (cont.)



LIP Web team develops and supports a wide range of web services

- Secretariat Portal
- Material / Missions Request
- Events plataform with Secretariat Admin panel
- Conference Room Booking
- Users Wiki
- Bulletin (LIP News)
- Indico (to be updated)
- Masterclasses
- CERN Portuguese Teachers School program
- IDPASC network
- Ibercivis
- Portuguese for health Summer School website
- Education Portal (under development)
- Publications Portal (under development)

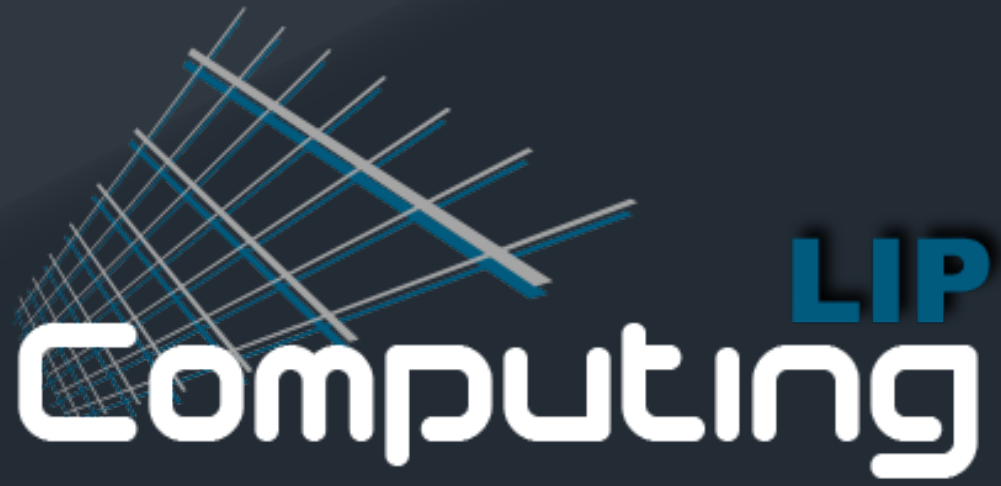
Other Services @ LIP

- LIPCA (Certificates)
- E-Mail/Webmail
- Mailing Lists
- Users webpages
- NFS Servers (homes, soft)
- DHCP (connectivity)
- DNS
- Desktops/Laptops (support)
- Login cluster
- Interactive cluster (Fermi)
- Printers
- Video-conference systems
- Graphic design
  (cards, flyers, brochures and posters)
- Security
- Intranet
- MySQL DB Cluster
- DB replication of Coimbra "Projects DB" to LIP-Lisbon
- Migration of some of the websites databases to the new cluster

Under development

- Cloud
- LDAP
- Single Sign-on

Questions?

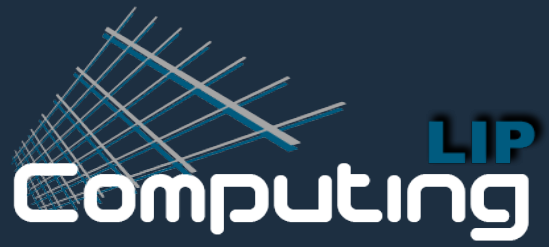


LIP Computing Activities

Worldwide LHC Computing Grid

Portuguese Tier2

Atlas and CMS



"LIP computing activities"

By Mário David

Portuguese federated Tier2

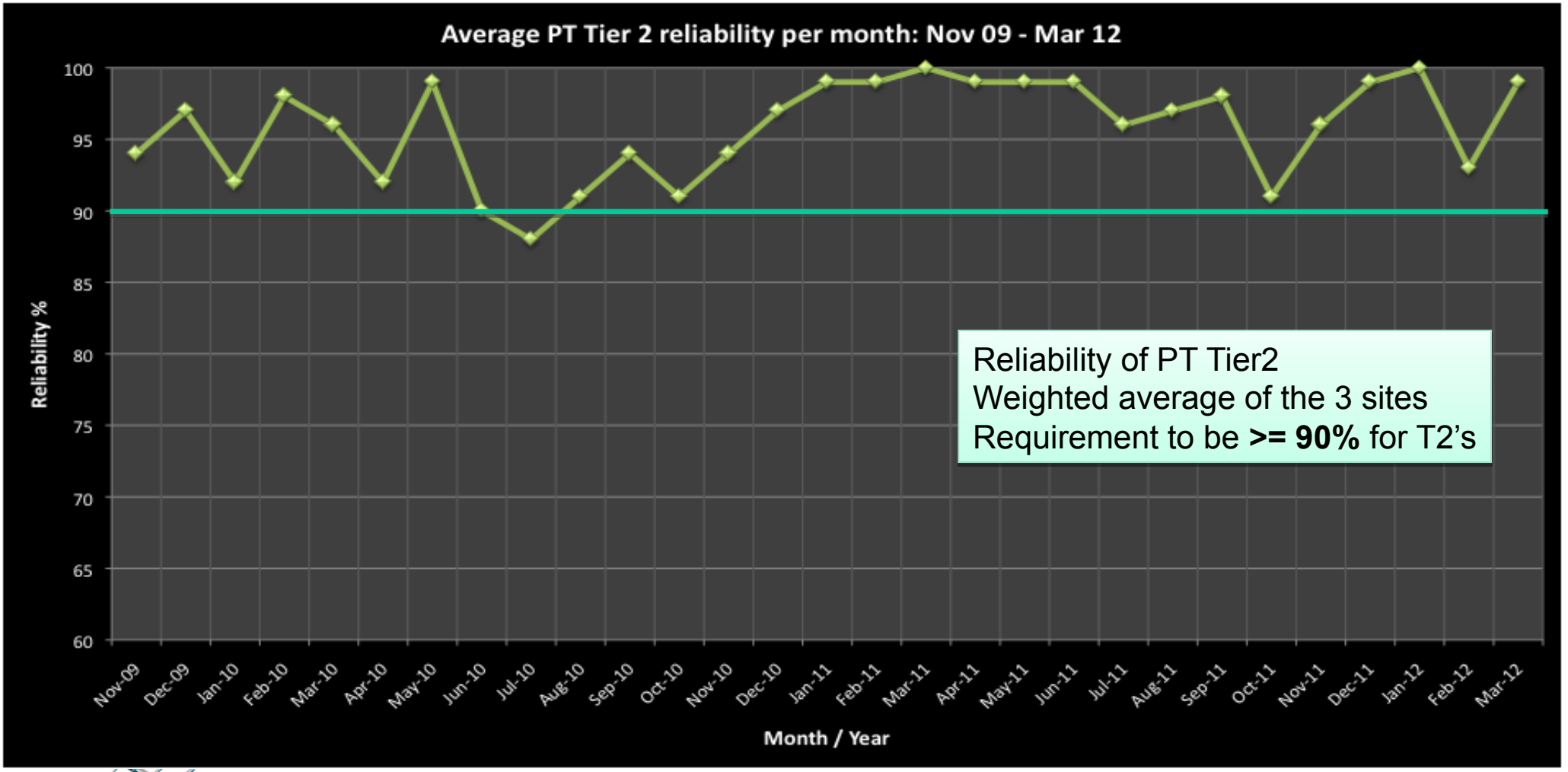
- Portuguese federated distributed computing facility:
  - LIP-Lisbon – supporting ATLAS and CMS
  - LIP-Coimbra– supporting ATLAS
  - NCG-INGRID-PT– National Grid Centre:
    - Supporting ATLAS, CMS and many other User Communities.
- Integrated into the WLCG through the Ibergrid and EGI grid infrastructures.
  - Fraction of computing power delivered per site

Site	LIP-Lisbon	LIP-Coimbra	NCG
Fraction % (Nov 09 – Mar 12)	29	13	58

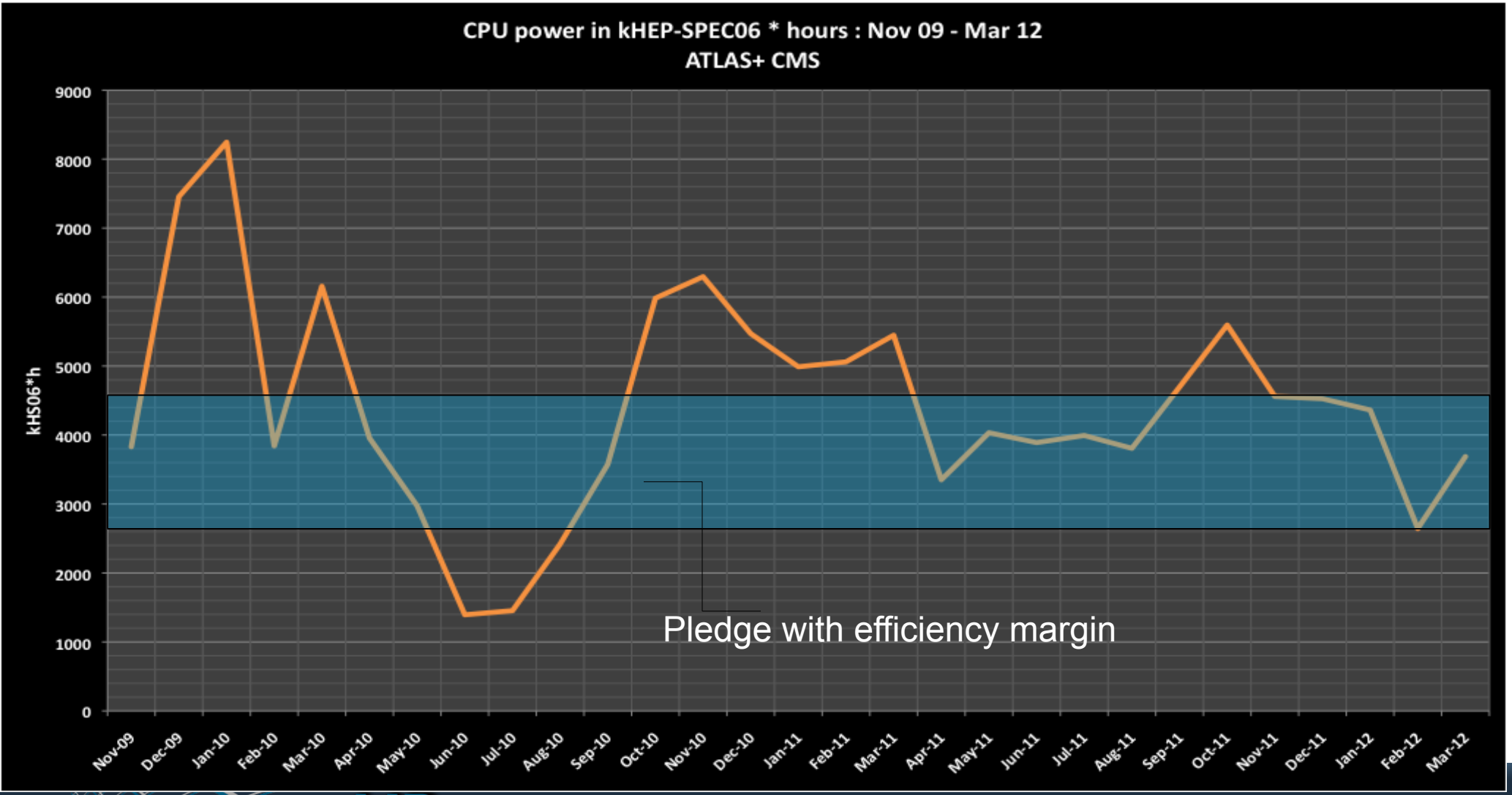
Portuguese federated Tier2

- Portuguese funding agency (FCT) signed in 2006, an MoU with CERN to deploy and operate a Tier 2 for ATLAS and CMS.
- WLCG pledges (2011-2013):
  - Storage:
    - 220 TB for ATLAS + 200 TB for CMS
  - Computing:
    - 3200 HEP-SPEC06 ATLAS + 3200 HEP-SPEC06 for CMS
    - HEPSPEC06 (HS06) – benchmark agreed upon to measure the CPU power. 1 Intel Xeon 54 or 55 family - 9 to 14 HS06.
  - Local ATLAS and CMS users have additional Tier-3 capacity for local analysis not in Tier-2 pledges.

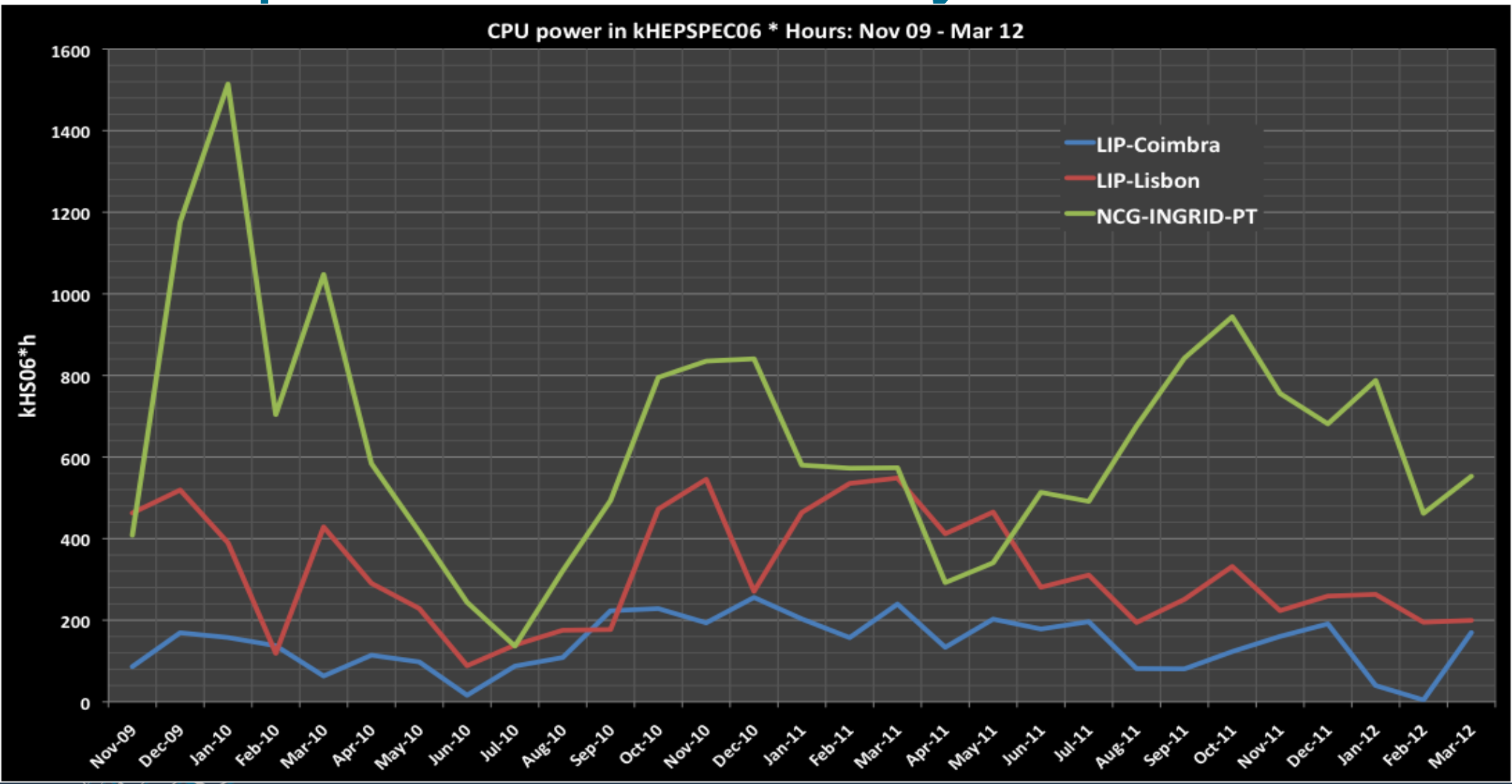
Performance - overall



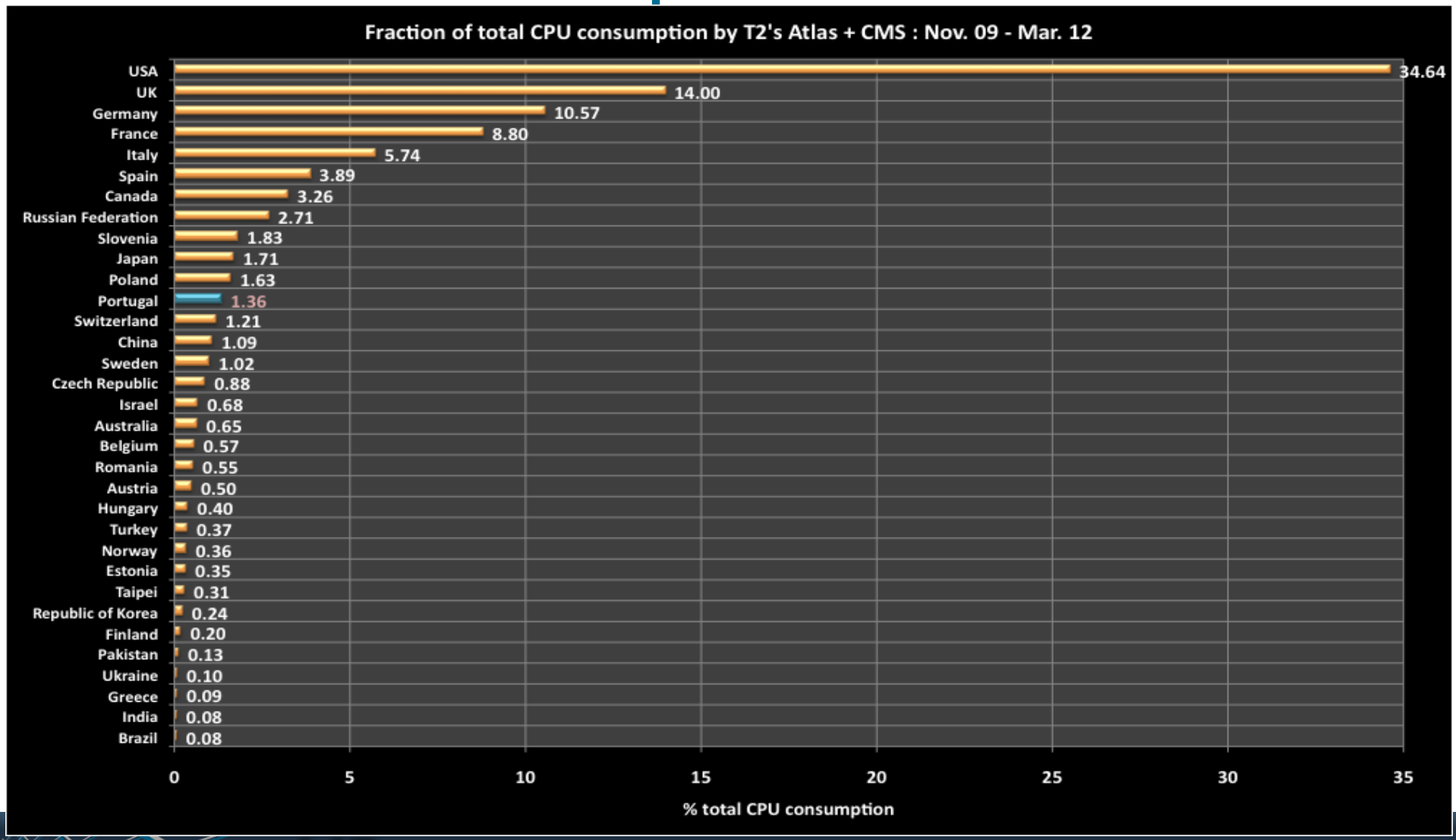
CPU power delivered by PT T2



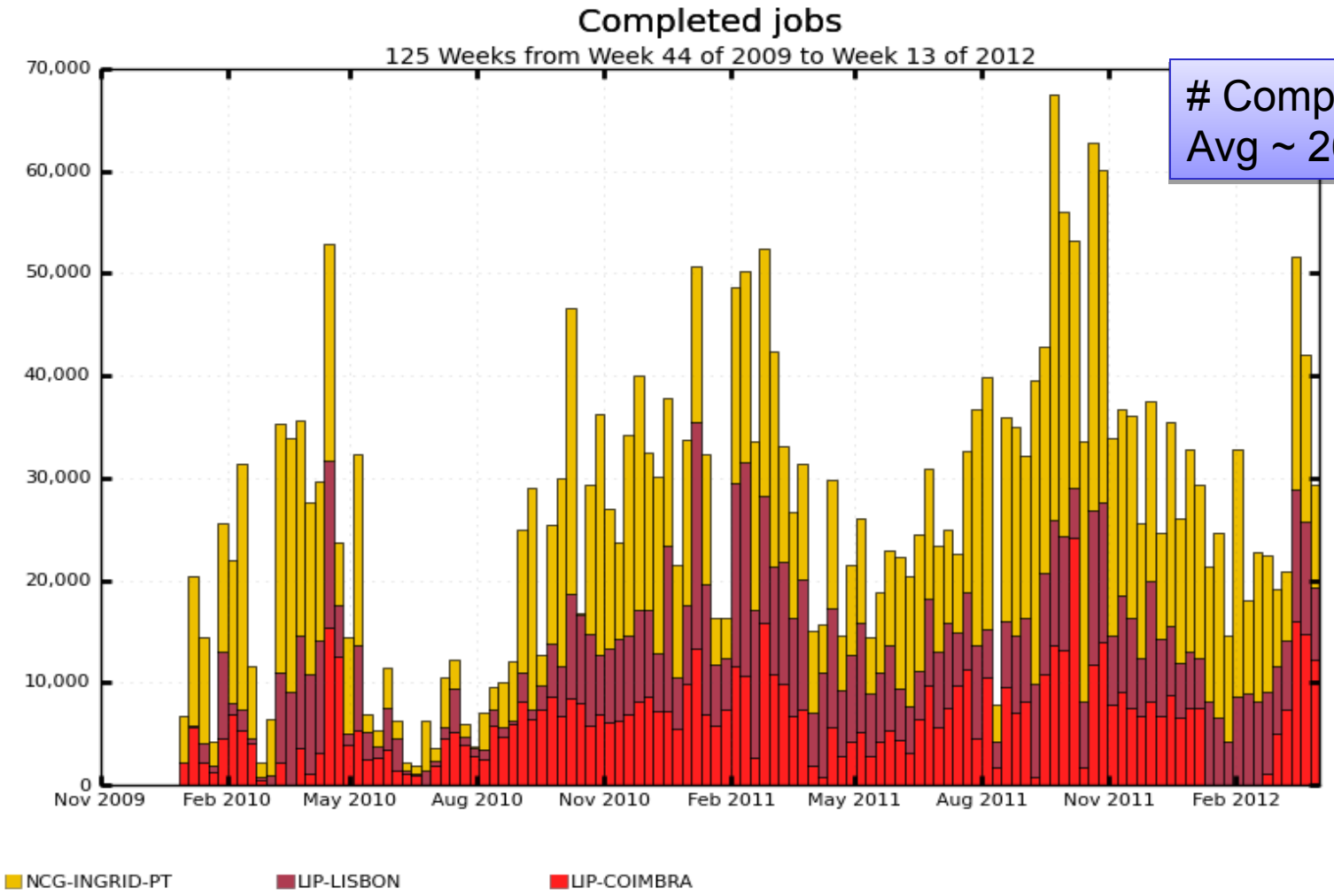
CPU power delivered by each site



% of Total CPU power – Tier2's

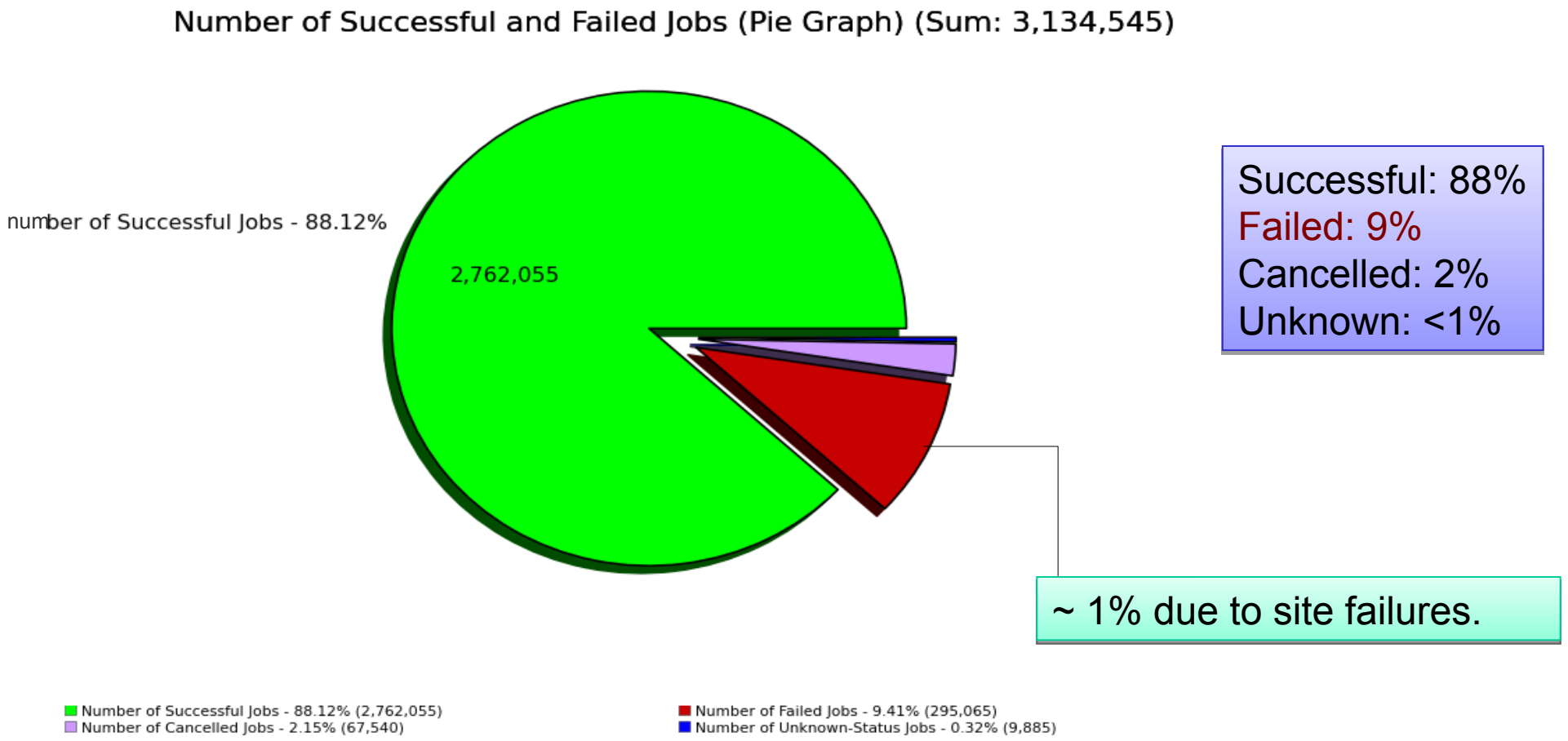


ATLAS (Nov 09 – Mar 12)



Completed jobs / week
Avg ~ 26 k

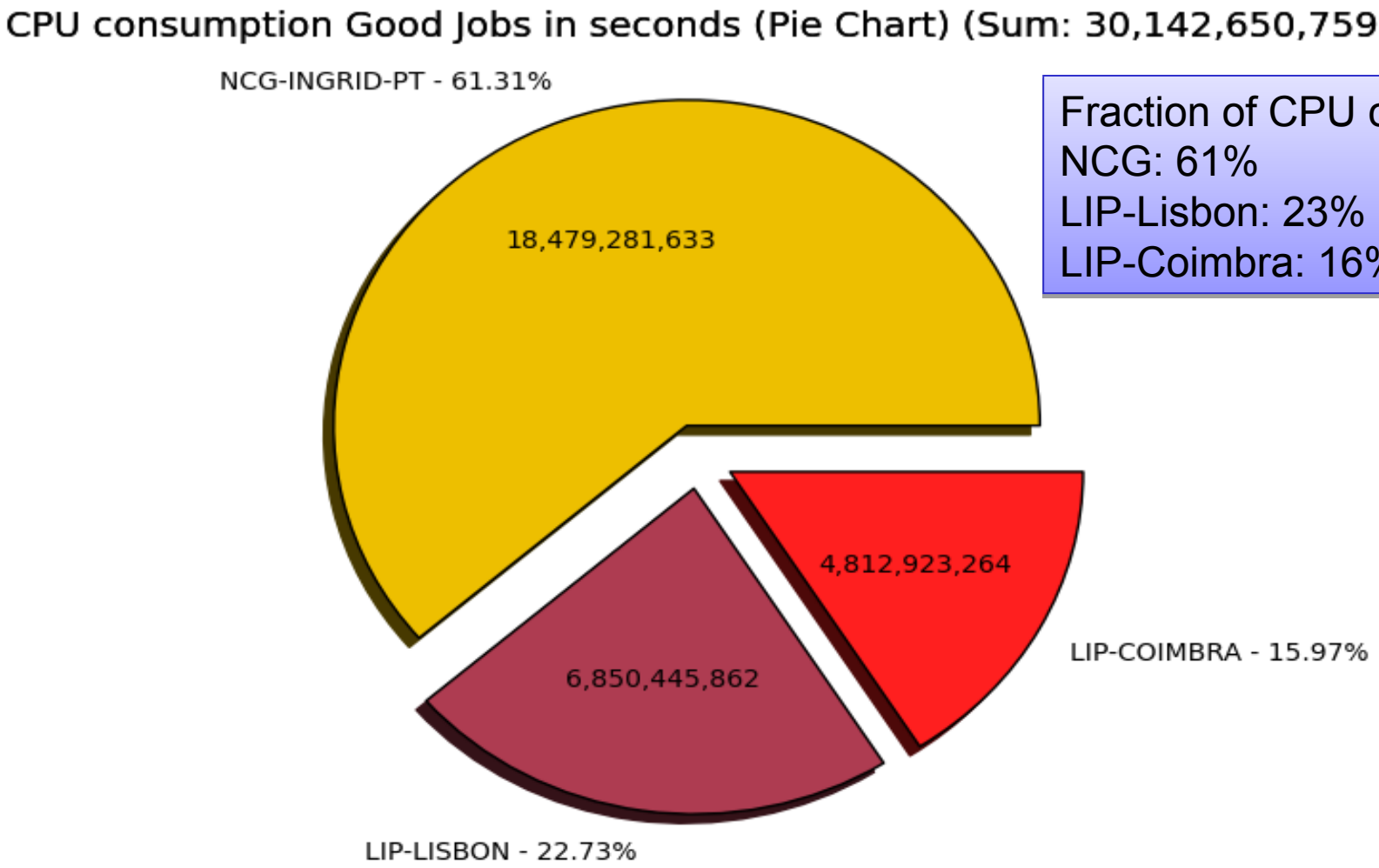
ATLAS (Nov 09 – Mar 12)



Successful: 88%
Failed: 9%
Cancelled: 2%
Unknown: <1%

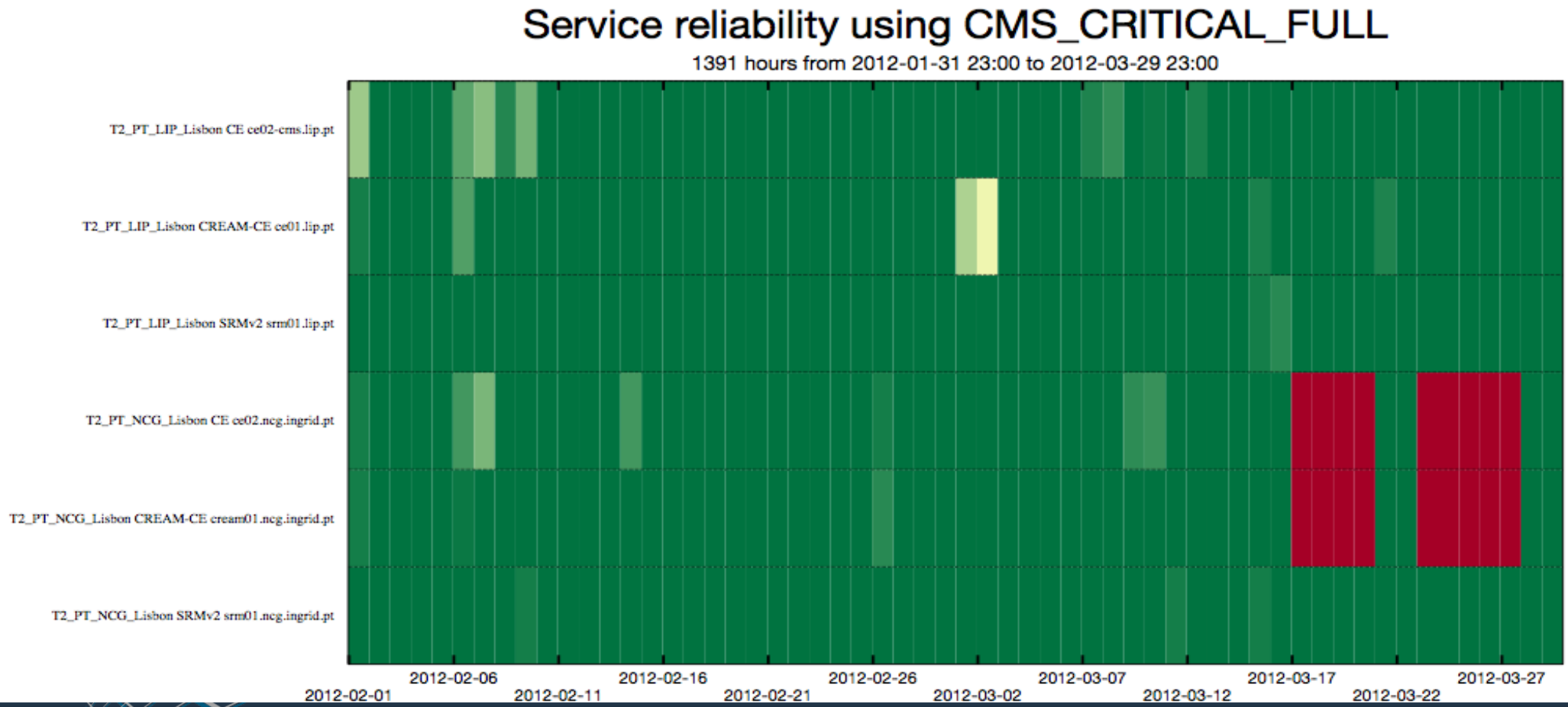
~ 1% due to site failures.

ATLAS (Nov 09 – Mar 12)

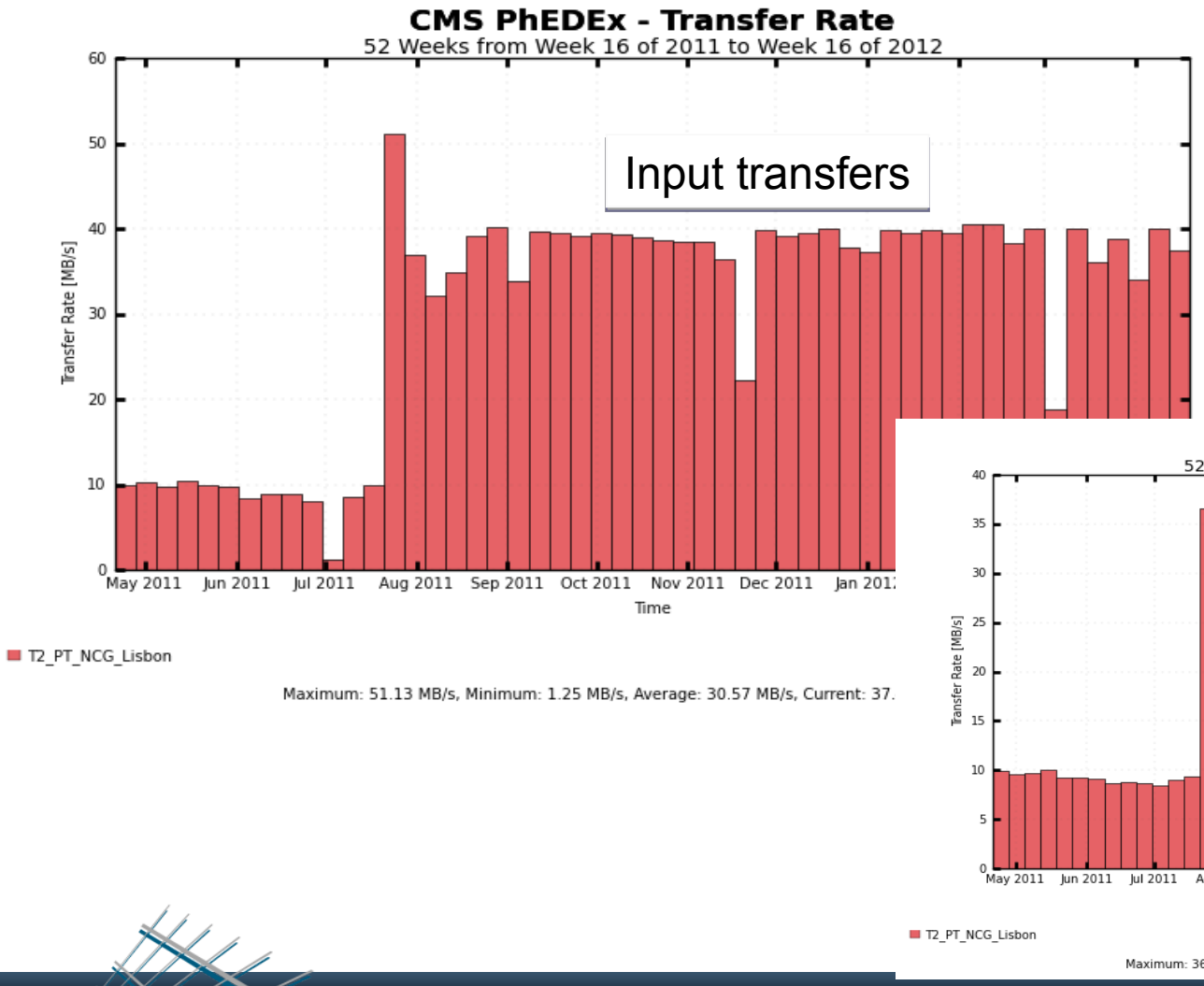


Fraction of CPU consumption:
NCG: 61%
LIP-Lisbon: 23%
LIP-Coimbra: 16%

CMS: NCG and LIP services reliability: Feb 12 – Mar 12

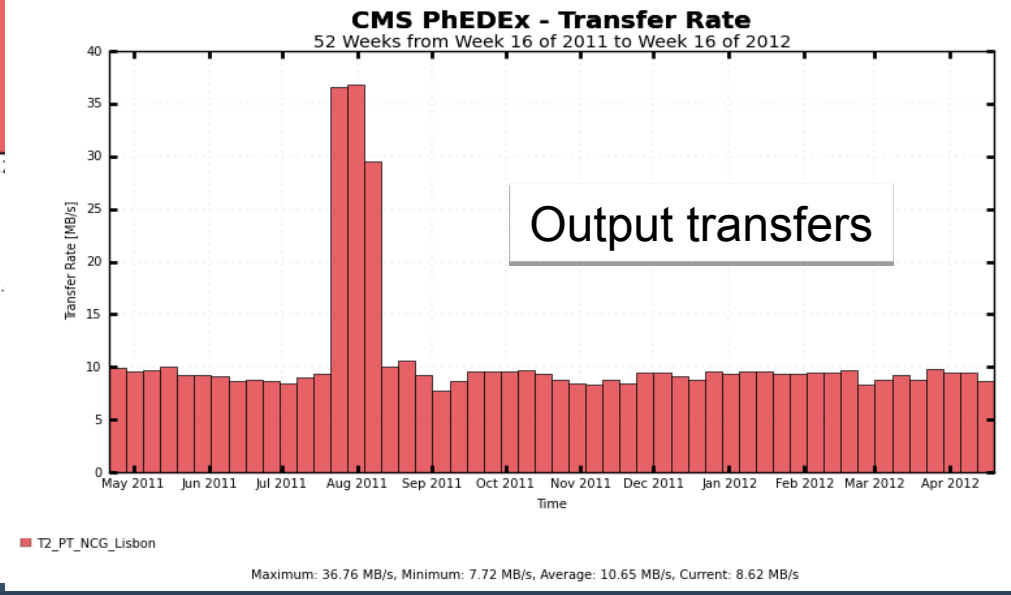


CMS: Phedex Debug instance



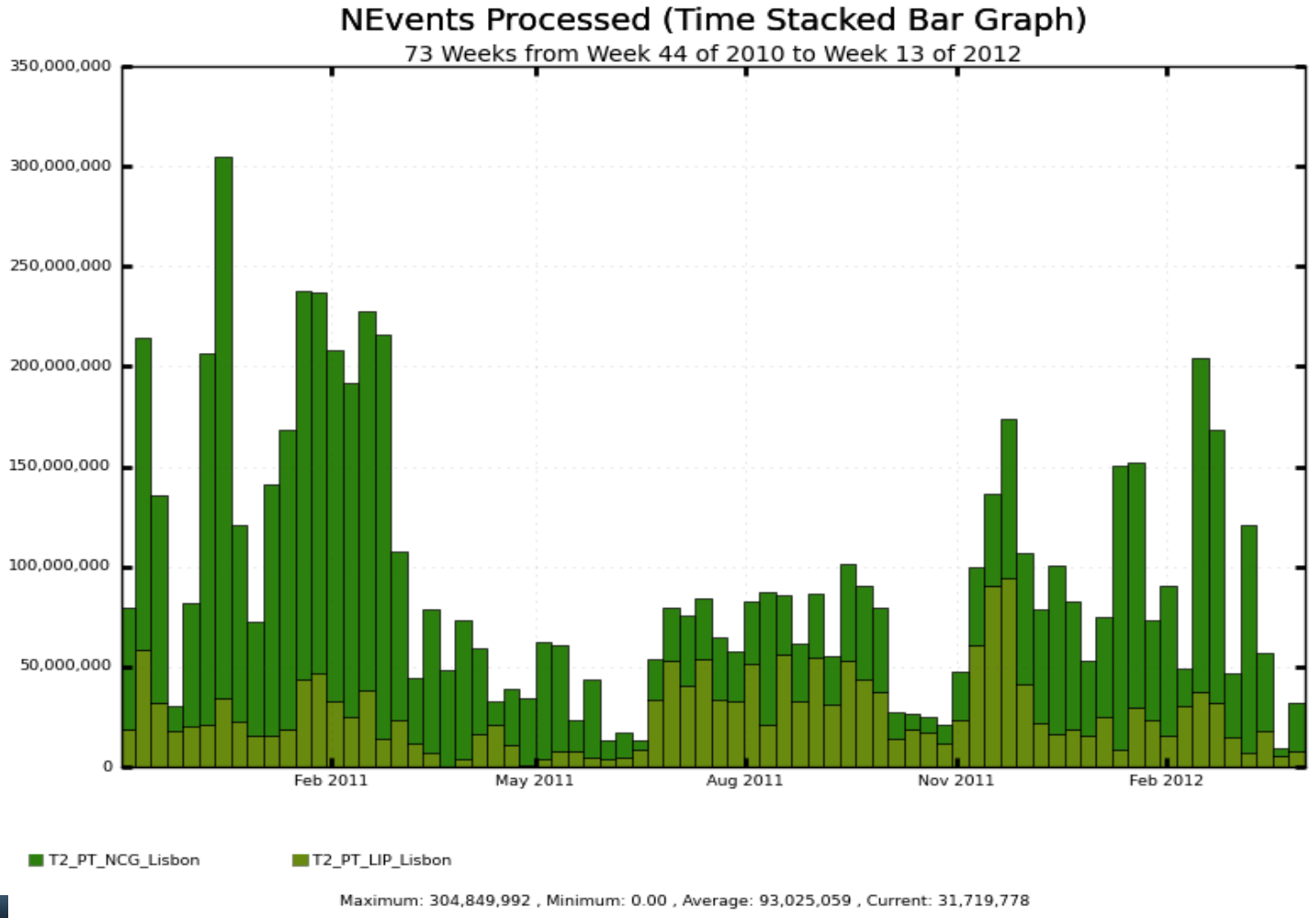
Sustained transfers during long period of time.

NCG: May 11 – Apr 12

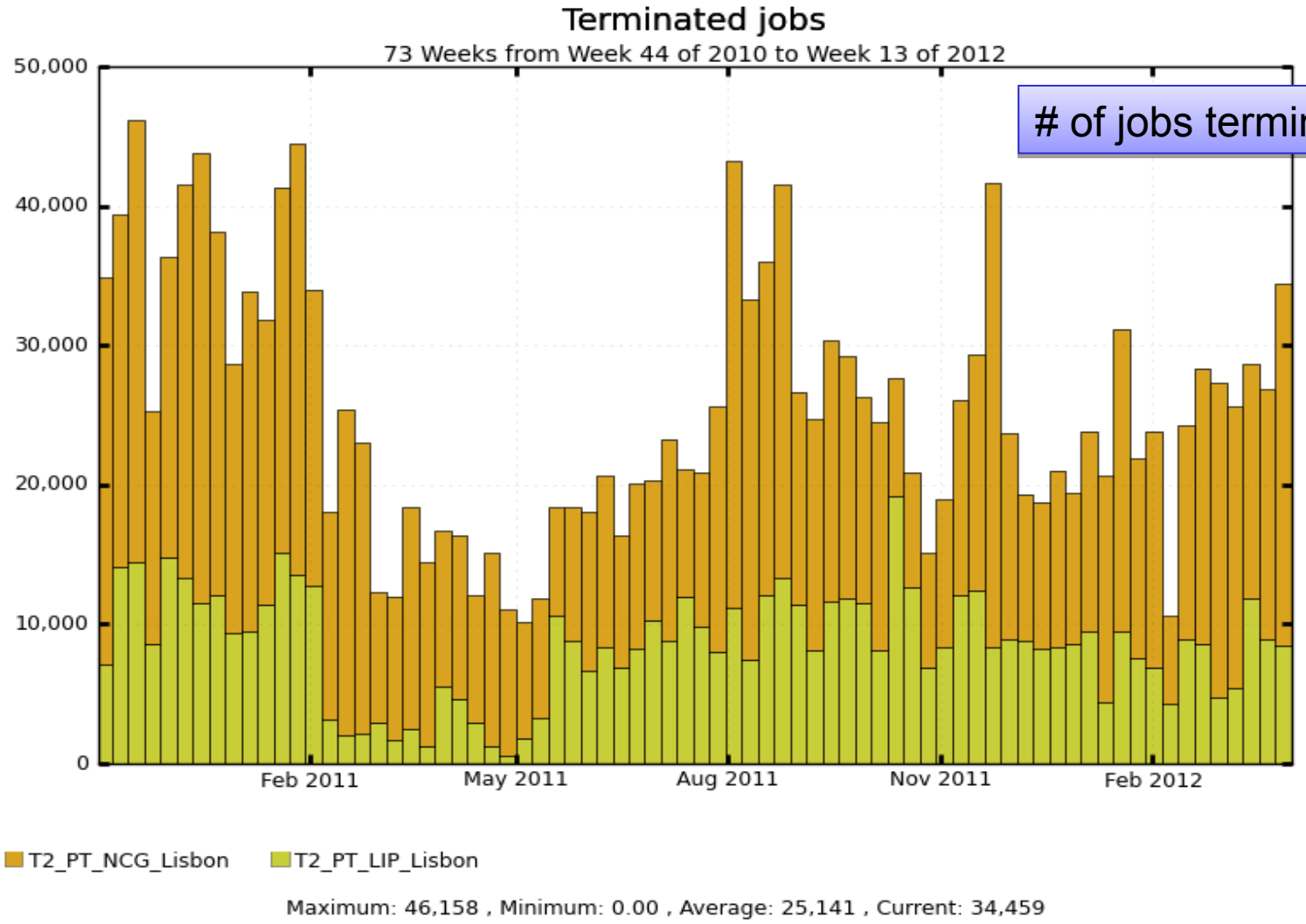


CMS (Nov 10 – Mar 12)

of events processed per week ~ 93 M



CMS (Nov 10 – Mar 12)



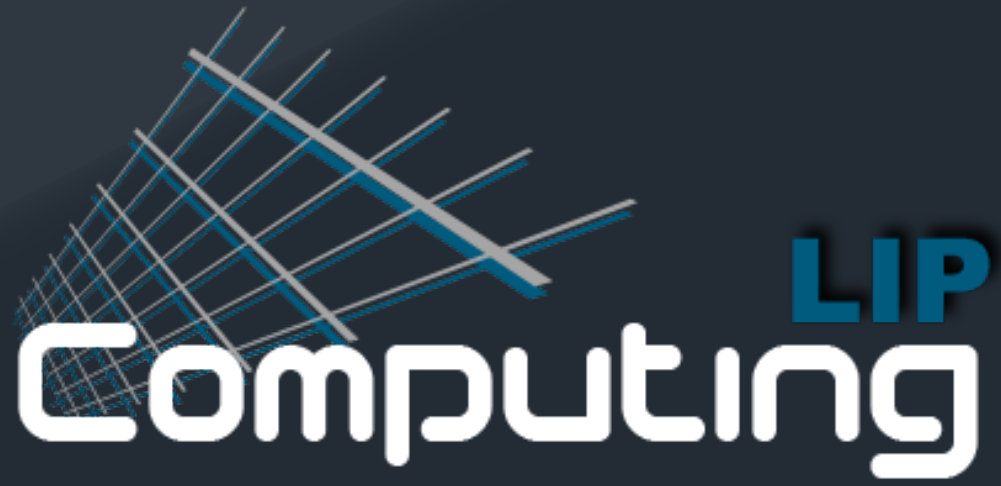
# of jobs terminated per week ~ 25 k

Thoughts - Conclusions

- Sites running well in the last years.
- Grid MW has become sufficiently stable – reflected in previous point.
- Local services:
  - Grid Engine as batch system and Lustre for storage have proven to be good choices:
  - Stable, scalable and robust.
- HW also OK (LIP), at NCG a bit more problematic from time to time.

Thoughts - Future

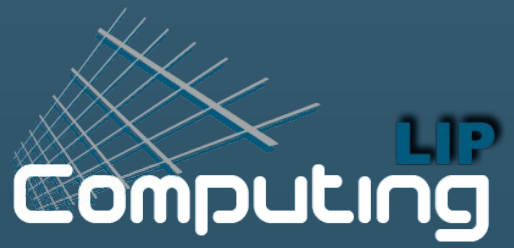
- Resources may become problematic:
  - Human resources – due to the “Ciência 2007 / 2008” FCT contracts ending in 2013 and 2014.
  - Electrical power cost growing:
    - Increase of TVA.
    - Increase of fixed costs (ERSE).
  - HW: support contracts ending this year – failures of components will be hard/expensive to replace.
    - Setting some currently active/production HW aside for spares.
- We have applied to FCT call for projects:
  - Partially replace Grid storage systems at LIP.
  - Partially cover operational costs.



LIP Computing Activities

e-Science Activities

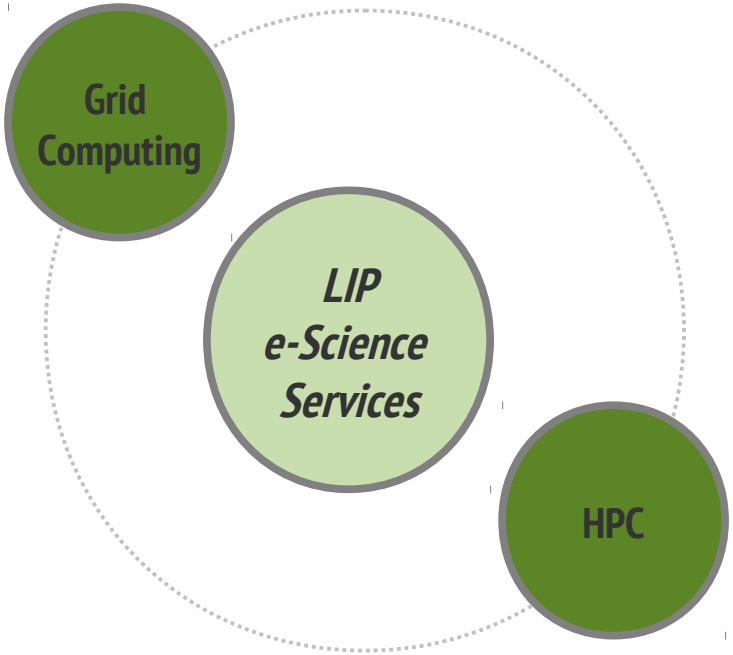
Research and Services for enhancing science

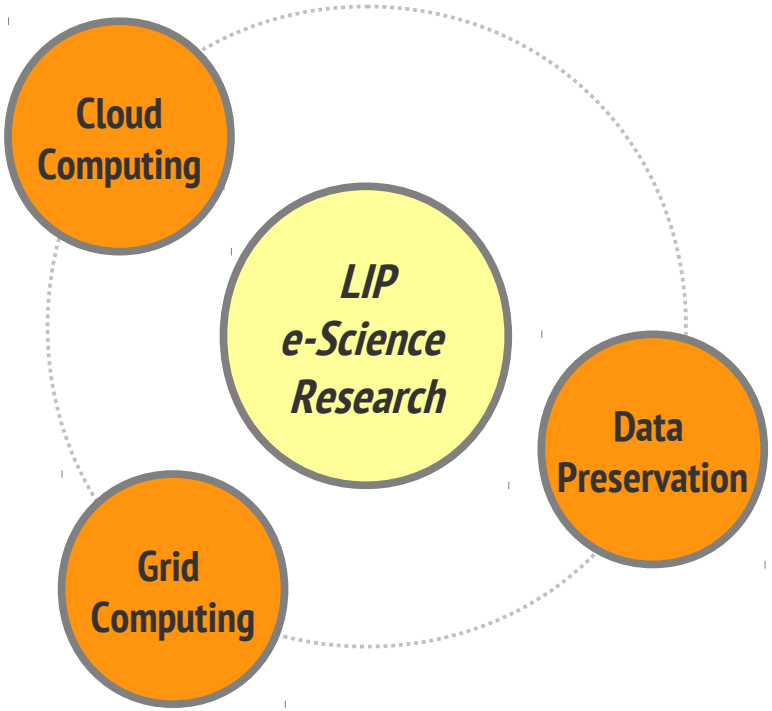


"LIP computing activities"

By Gonçalo Borges

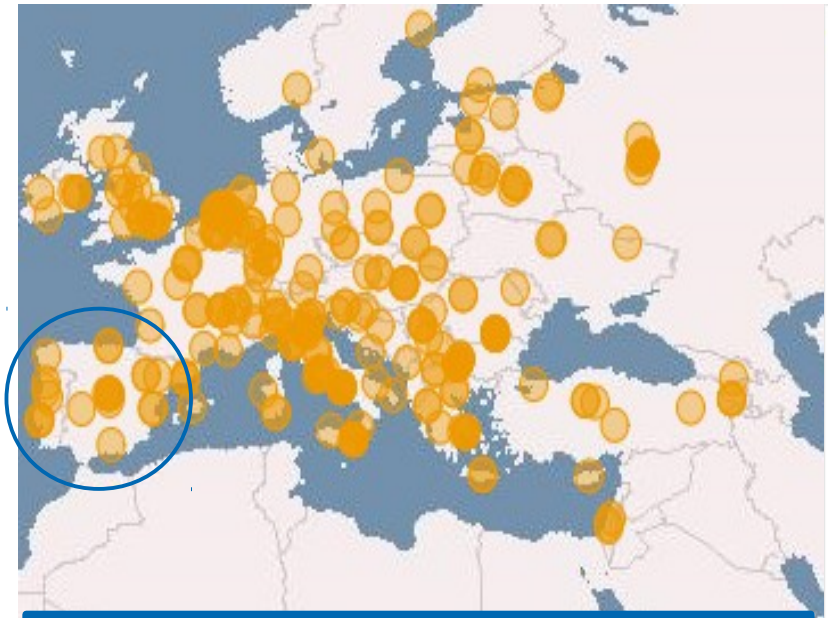
e-Science activities Overview

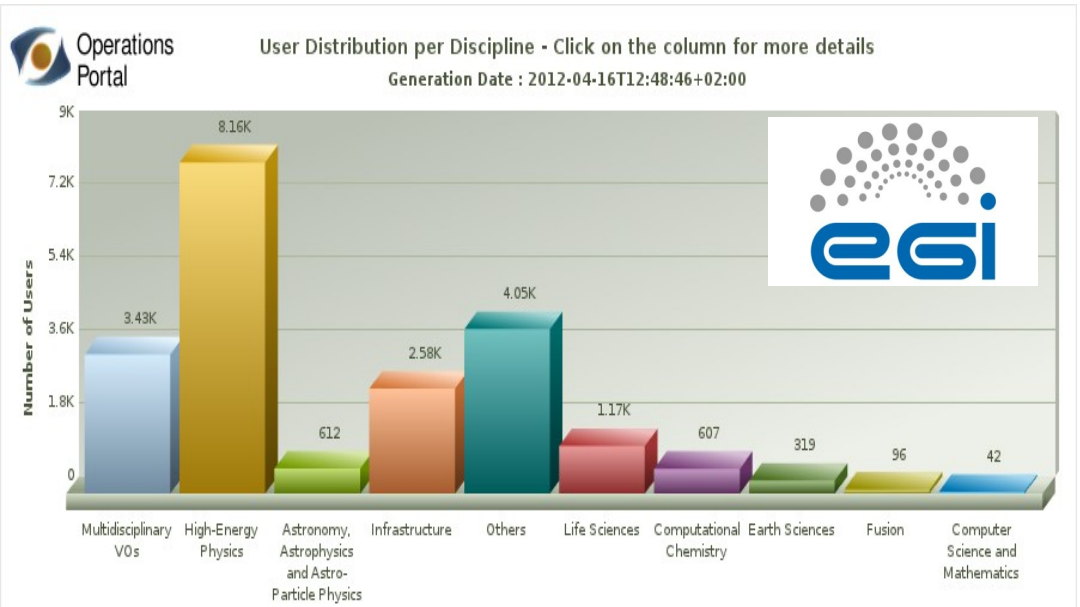




"Federation of Computer resources from multiple administrative domains to reach a common goal"

Grid Computing, EGI





- **42 Countries**
- **Resource Centres**
  - **323 EGI**
  - **108 supporting MPI (+12.5%)**
- **271,000 Logical CPUs (cores)**
  - **+13% since April 2011**
- **122 PB disk and 128 PB tape**

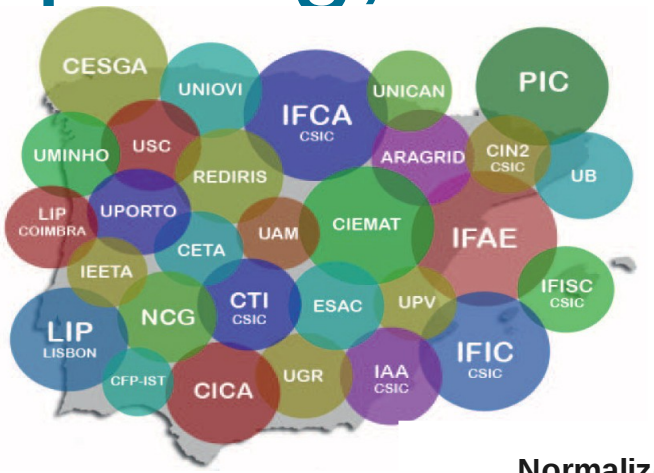
- **232 Virtual Organisations**
- **21,126 VO members**
  - **+13.5% since April 2011**
- **1,264,922 jobs/day**
  - **+32% since April 2011**
- **3.6M non-HEP jobs/month**
  - **+17.35% since April 2011**

"Federation of Computer resources from multiple administrative domains to reach a common goal"

Grid Computing, IBERGRID

Portugal:

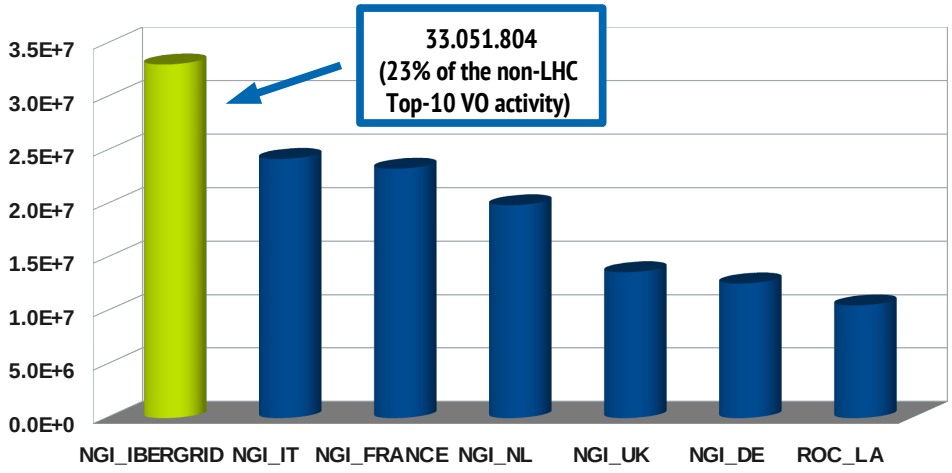
- **Logical CPUs (cores)**
  - **2,126**
  - **17,514 HS06**
- **638 TB of Storage**



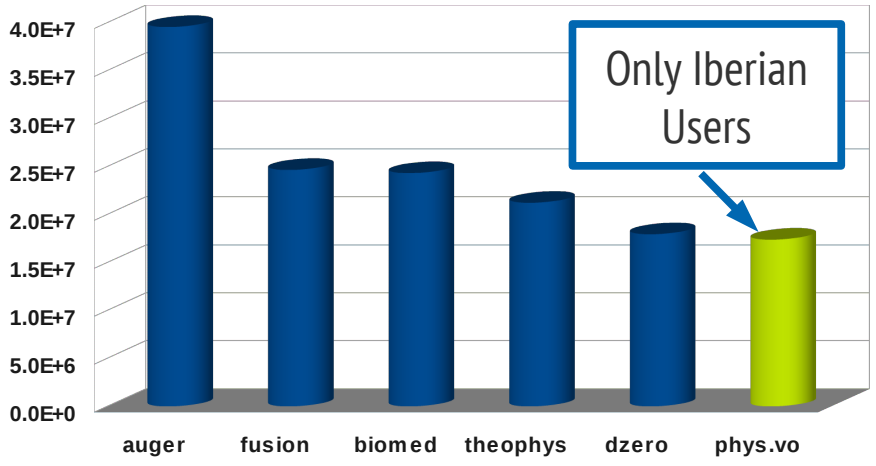
Spain:

- **Logical CPUs (cores)**
  - **15,696**
  - **16,0647 HS06**
- **11,460 TB of Storage**
- **5,922 TB of Storage Tape**

Normalized CPU time for top 10 non-LHC VOs (HS06 hours since Jan 2012)



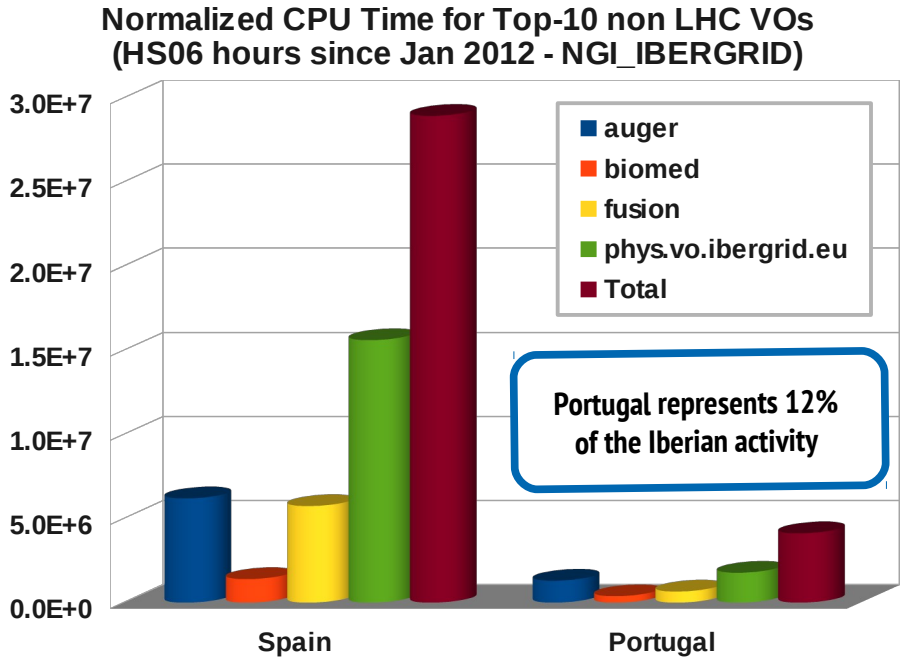
Normalized CPU Time for Top 10 non-LHC VOs (HS06 hours since Jan 2012)

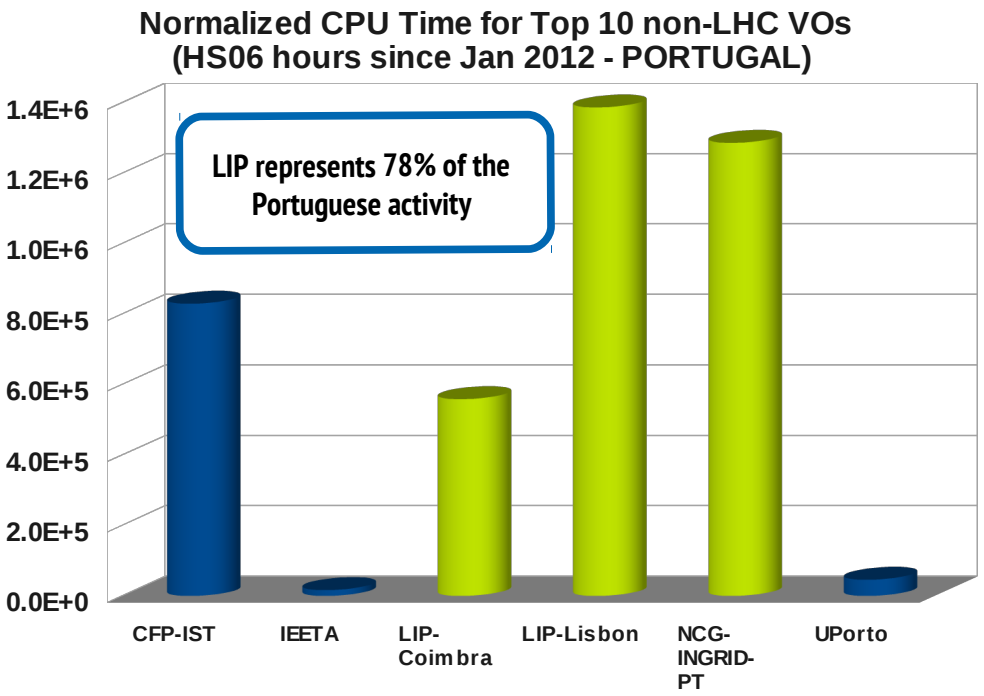


"Federation of Computer resources from multiple administrative domains to reach a common goal"

Grid Computing, INGRID

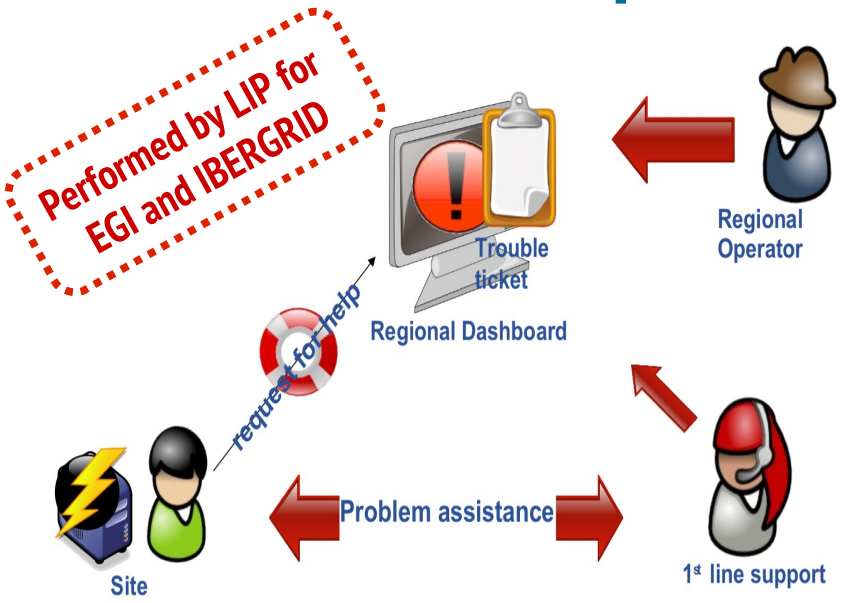
- 7 Resource Centres
- LIP (Lisbon, Coimbra and NCG)
  - 78% of the PT activity excluding LHC VOs





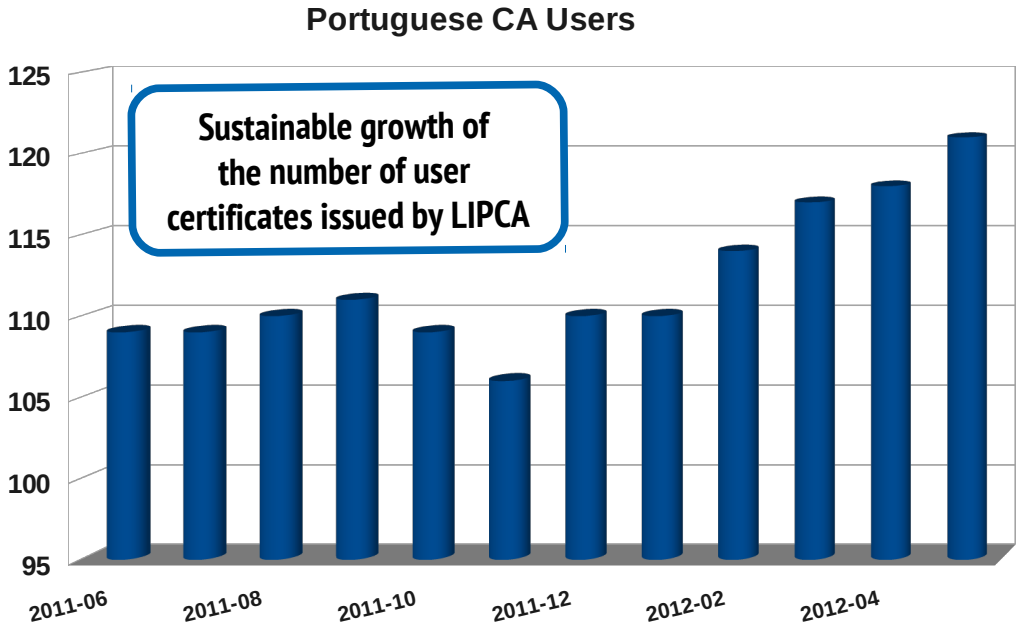
"Federation of Computer resources from multiple administrative domains to reach a common goal"

Grid Computing, National Services



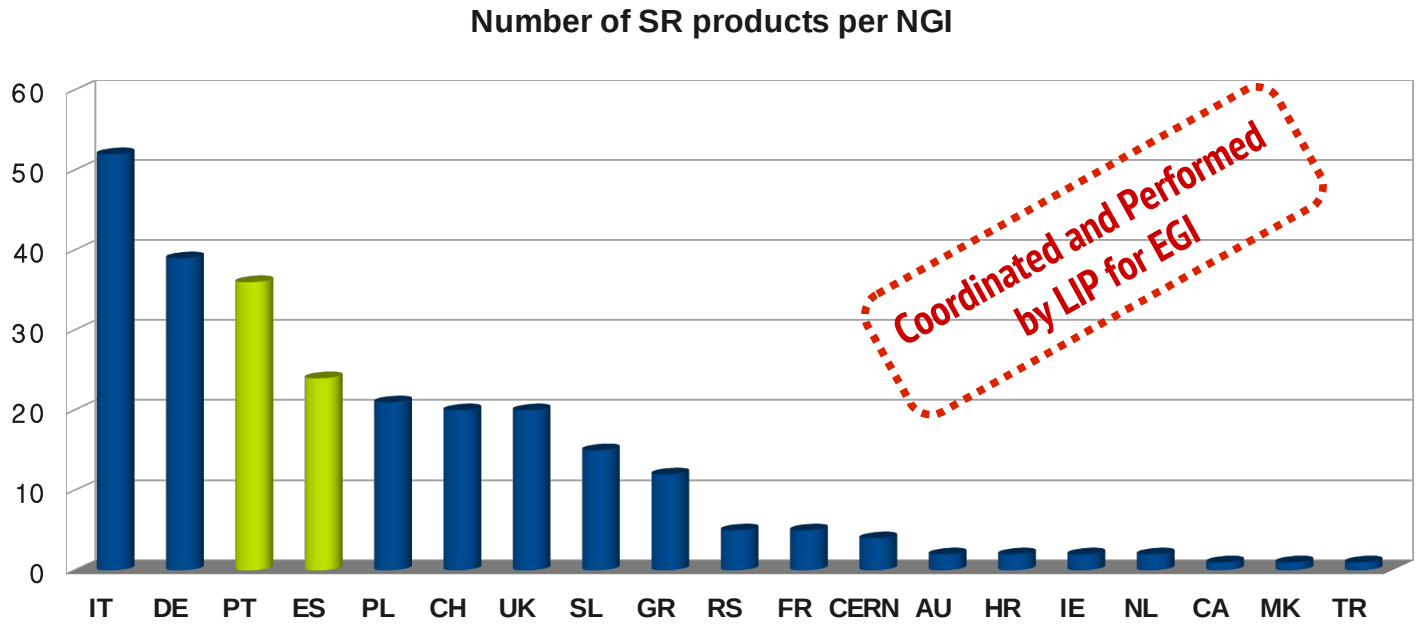
- Coordination of operations
  - Operation of central grid services and tools for EGI and IBERGRID
  - Support users and administrators

- LIPCA: Management of X509 certificates



Grid Computing, Global Services

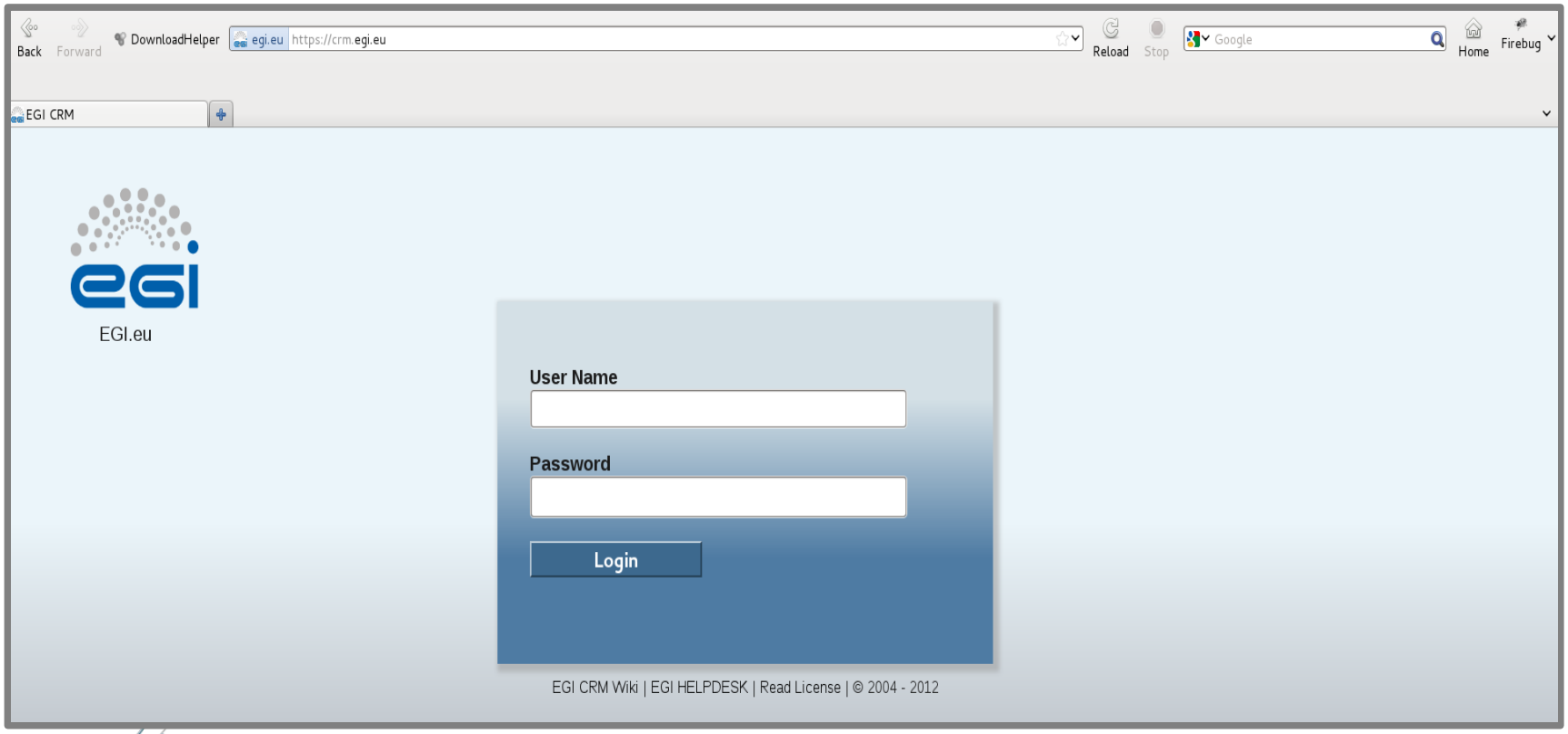
- Coordination of Stage Rollout (SR) in EGI infrastructure
  - SR is a process whereby Early Adopter sites are the first ones to deploy new middleware services into production
  - 6 UMD Releases with more than 70 updates tested by Early Adopters



"Federation of Computer resources from multiple administrative domains to reach a common goal"

Grid Computing, Global Services

- Operation of the EGI Client Relationship Management Tool
  - Manage EGI user community information and register possible leads



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Grid Computing, Global Services

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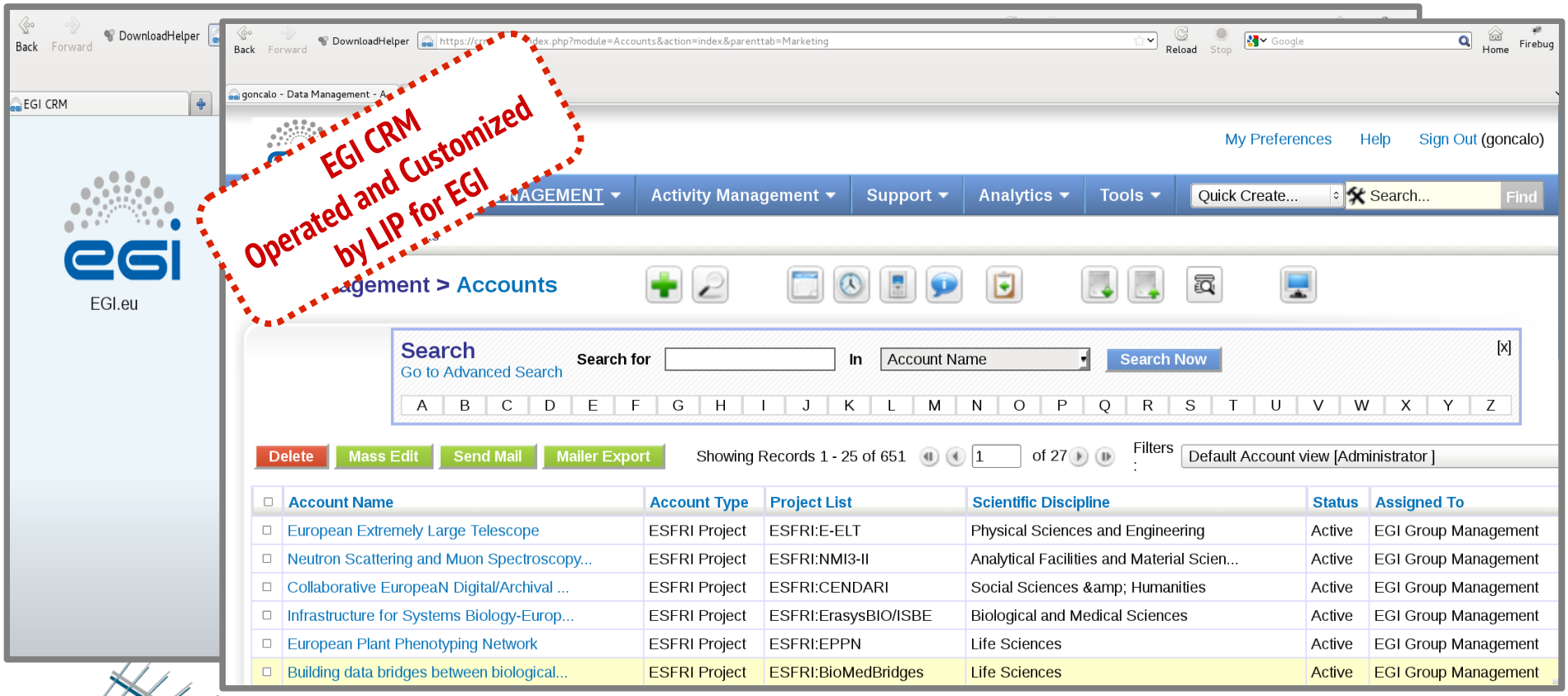
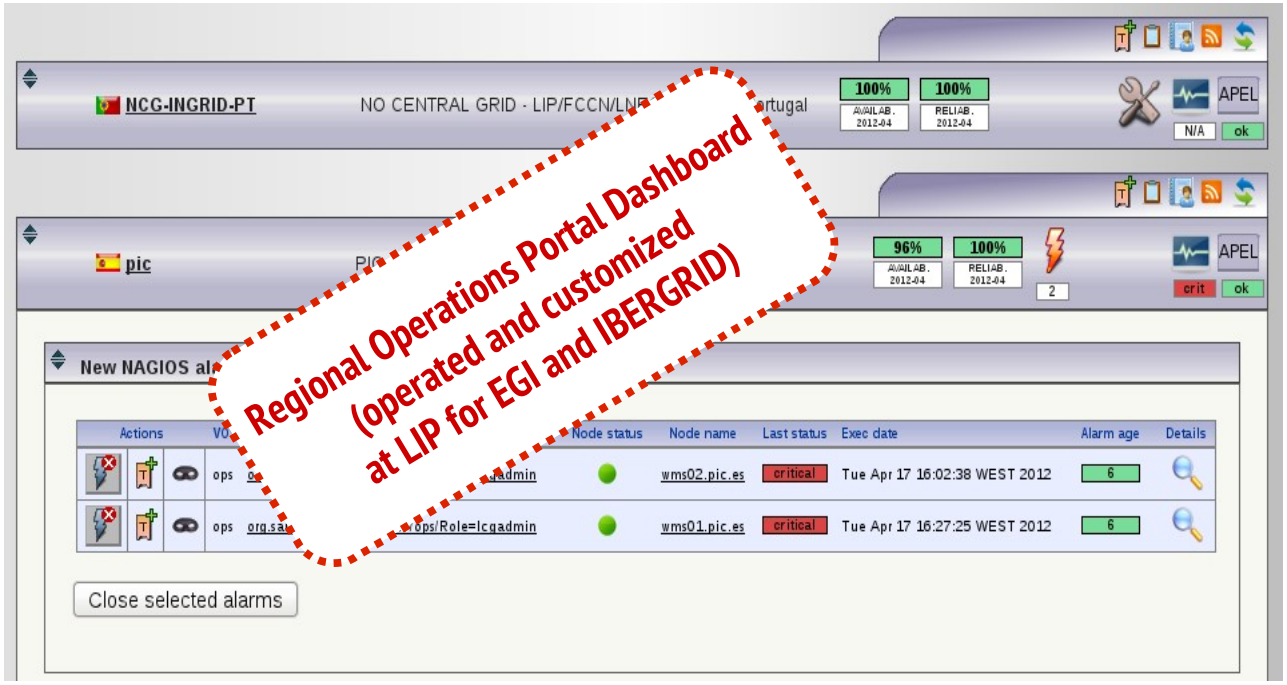
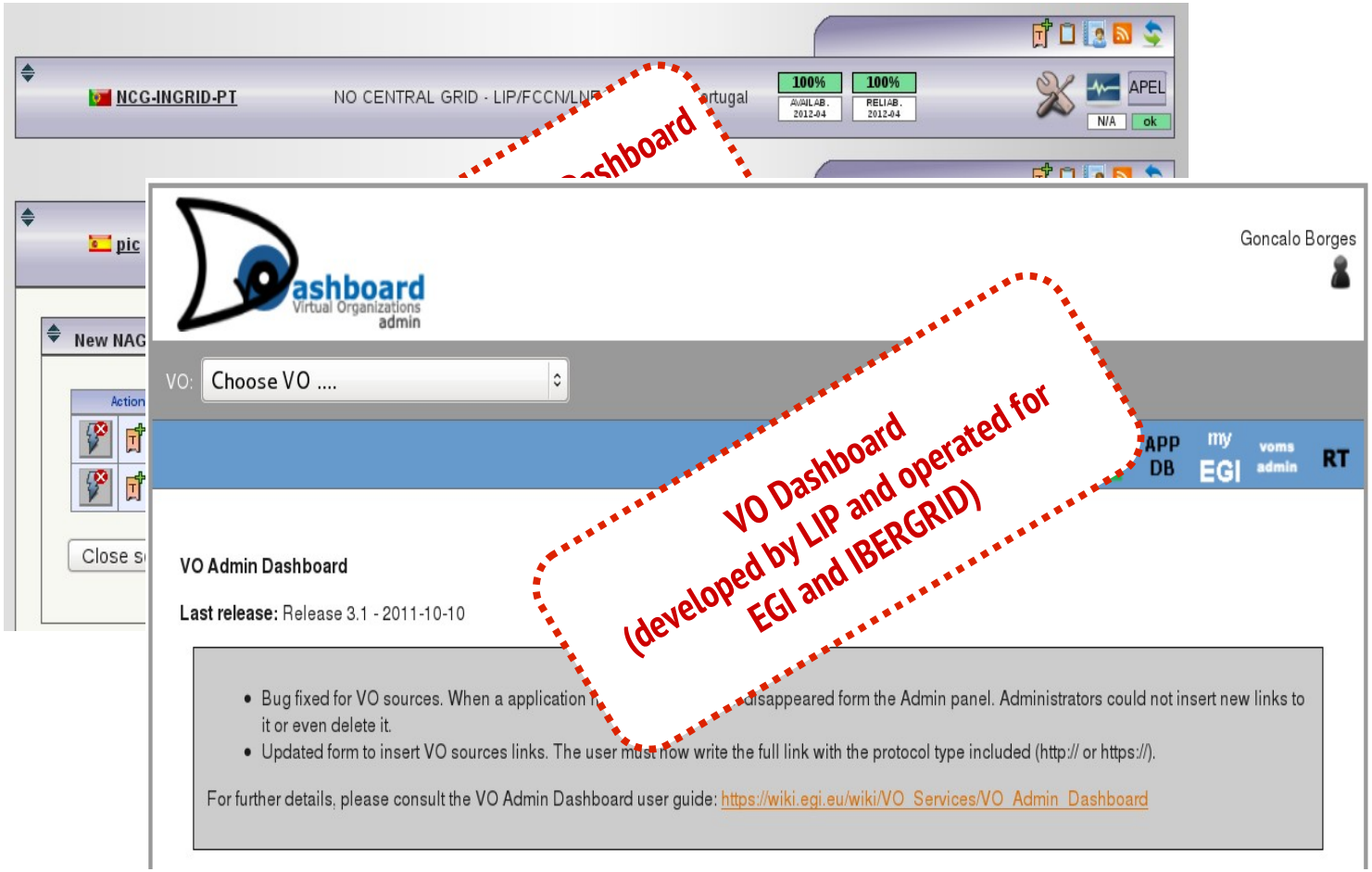


Grid Computing, Other Services



"Federation of Computer resources from multiple administrative domains to reach a common goal"

Grid Computing, Other Services



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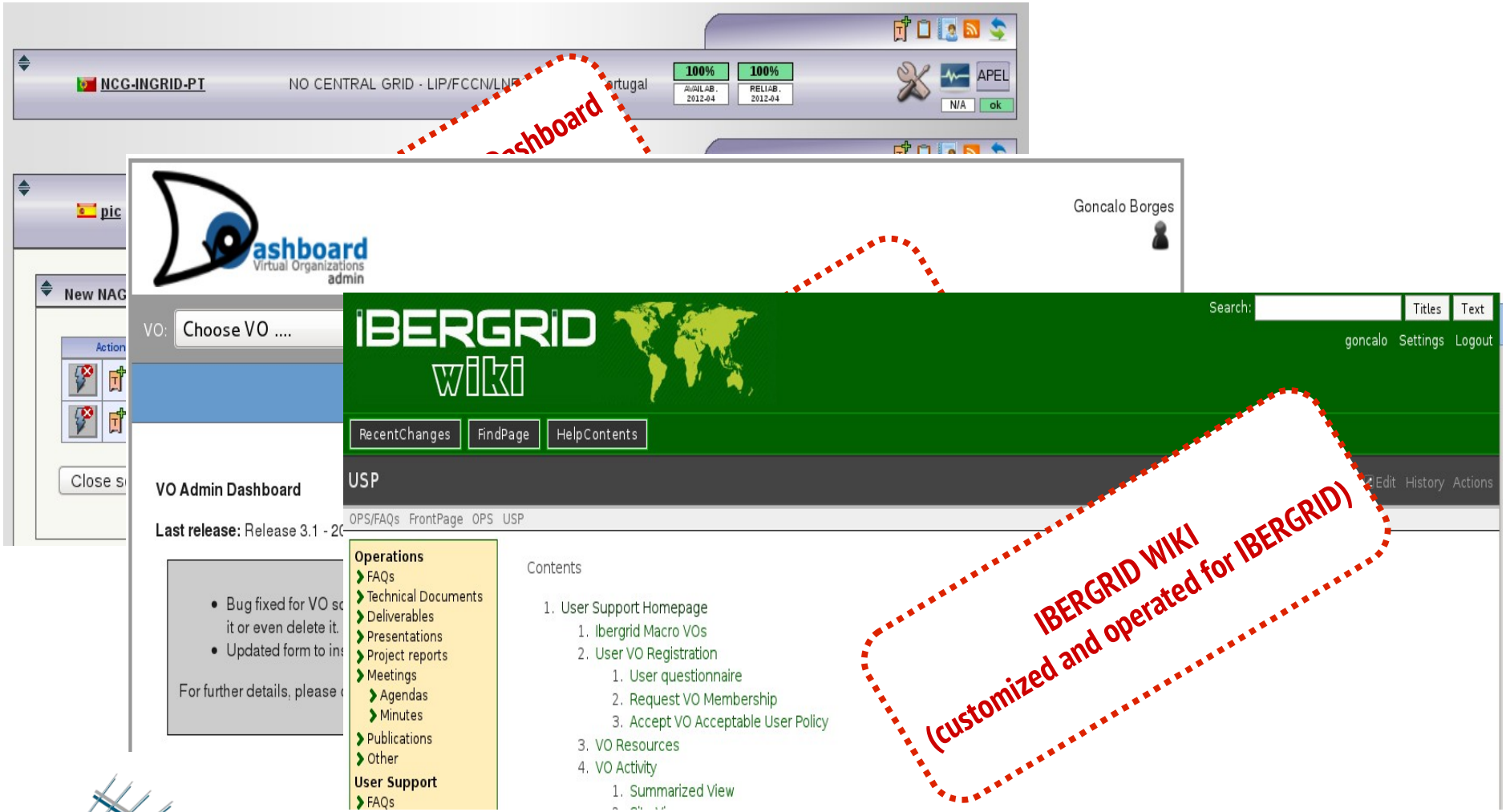
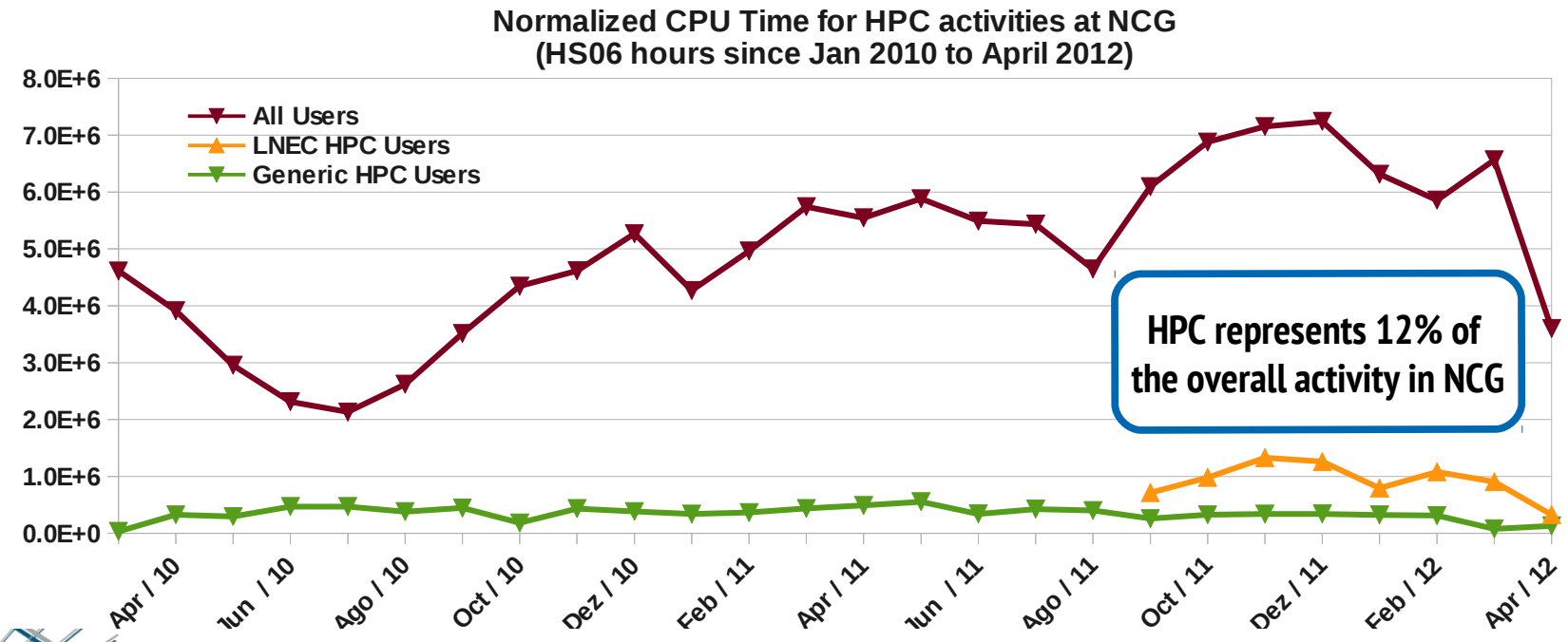
Grid Computing, Other Services



HPC Service, INGRID

- For researchers with low latency requirements for parallel jobs:
  - NCG resources with infiniband (8 Gbps) interconnect
  - NCG resources with Gigabit Ethernet (1Gbps) interconnect
  - LNEC resources with Gigabit Ethernet (4Gbps) interconnect

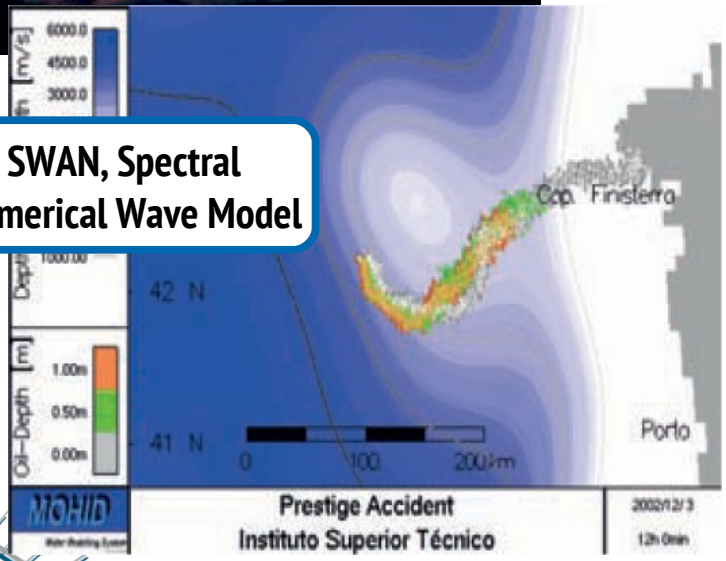


Grid Computing & HPC, Applications

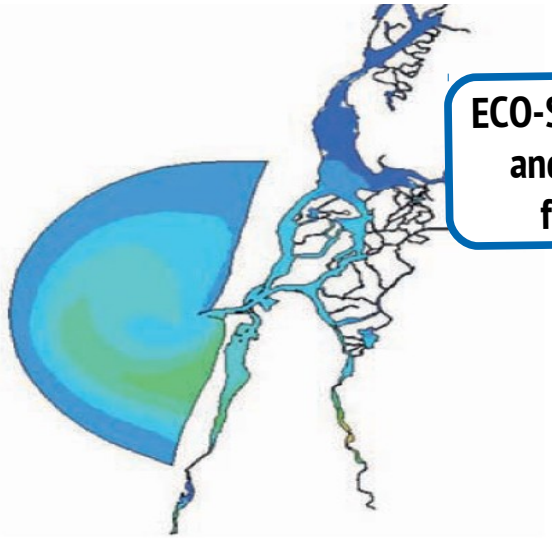
BING, Brain Imaging Network Project Grid

PJET, Simulation of turbulent plane jet

SWAN, Spectral Numerical Wave Model



ECO-SELF, hydrodinamical and ecological model for Aveiro Lagoon



Grid Computing & HPC, Applications

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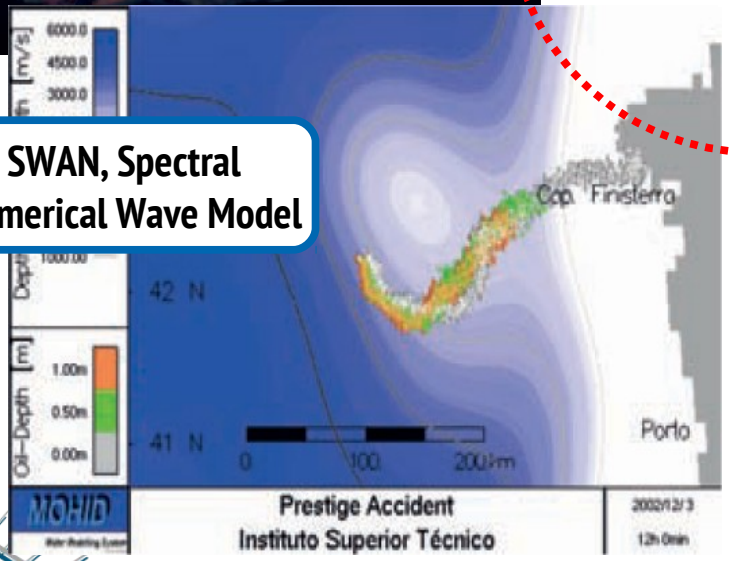
Ported by LIP

SWAN, Spectral Numerical Wave Model



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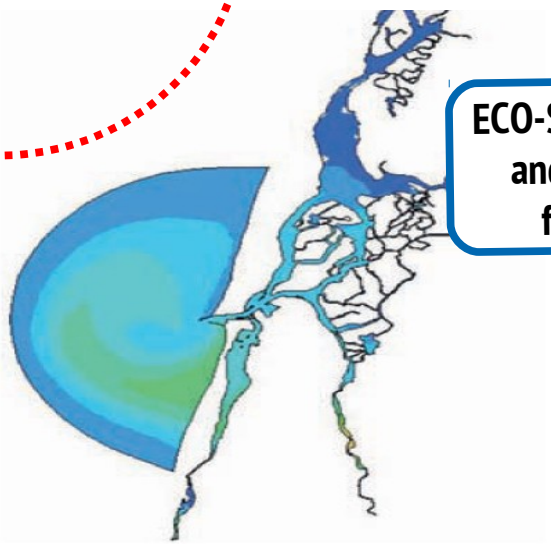


Cloud Computing, IBERCLOUD

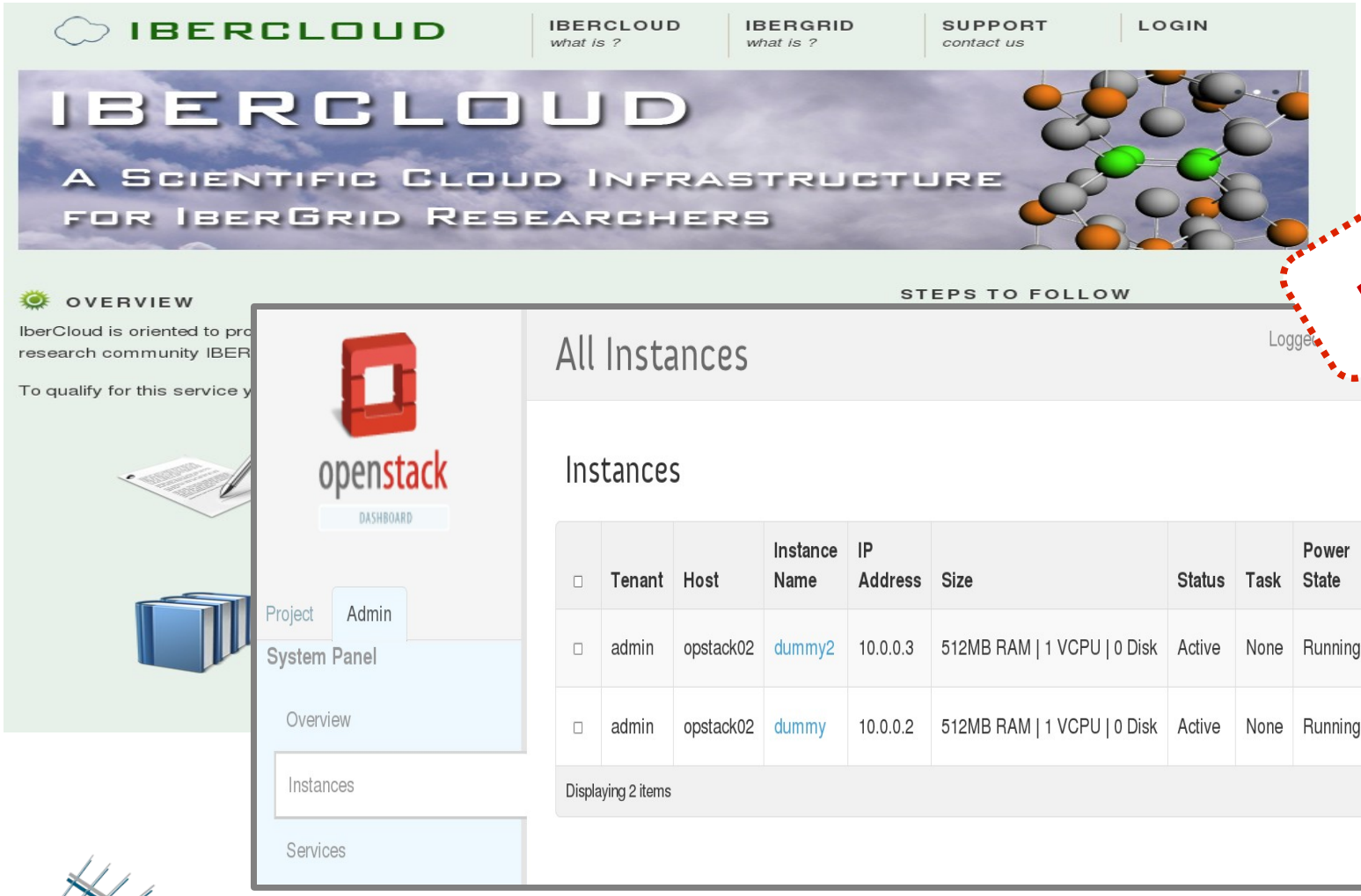
- Iberian federated infrastructure
  - Federated resources: LIP, IFCA, UPV, CESGA
  - Integrating different virtualization engines
  - Amazon (EC2 and S3) compatibility
  - LIP responsible for the authentication mechanisms

IBERCLOUD

R&D at LIP

- A user centred infrastructure
  - Define the properties of the machine
  - Define for how long it will need it
  - Have interactive access

Cloud Computing, IBERCLOUD

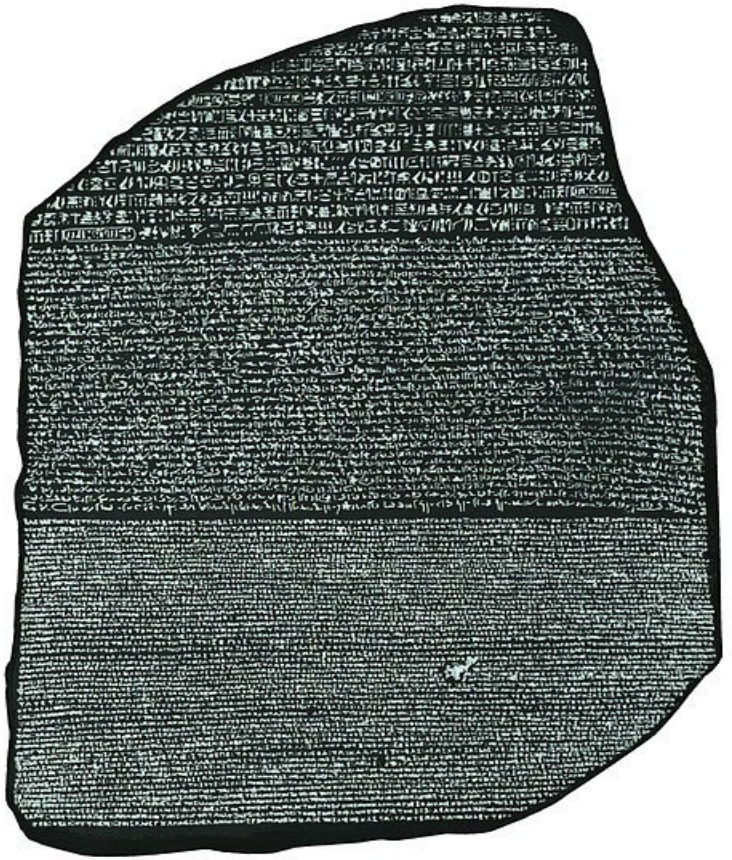


Data Preservation, Timbus

R&D at LIP

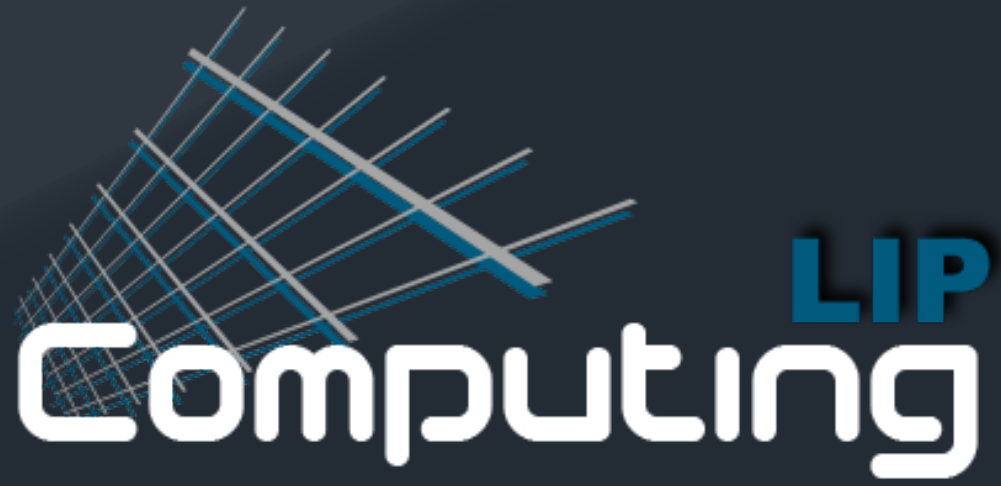
TIMBUS
TIMELESS BUSINESS
Sponsored by the European Commission Directorate for Information Society

- LIP participation aiming long term preservation of HEP analysis performed by local researchers
- Enable systematic archival of all the analysis steps
- Replay analysis actions by re-running the same programs as the researcher did in the past
- Running adapted/modified versions of this same programs, and/or by using different data sets.



Summary and Future

- Effort will continue on delivering high quality services
  - In the context of the Initiatives where LIP is involved and where its work as been acknowledged
- Research & Development
  - Investment on Cloud Computing
  - Implementation of Data Preservation principles
  - Best practices towards better infrastructure management
- Critical issues
  - Sustainability of the e-Science infrastructures in Portugal (Political will / Human Resources)



LIP Computing Activities