



Cyberinfrastructure for chemical weather forecast



Eugenio S. Almeida

Centro de Previsão de Tempo e Estudos Climáticos (CPTEC)
Instituto Nacional de Pesquisas Espaciais (INPE)

Agenda

- Introduction
- SAEMC Grid
- Network connectivity
- SAEMC Portal
- Portal development and integration
- Conclusions



Introduction

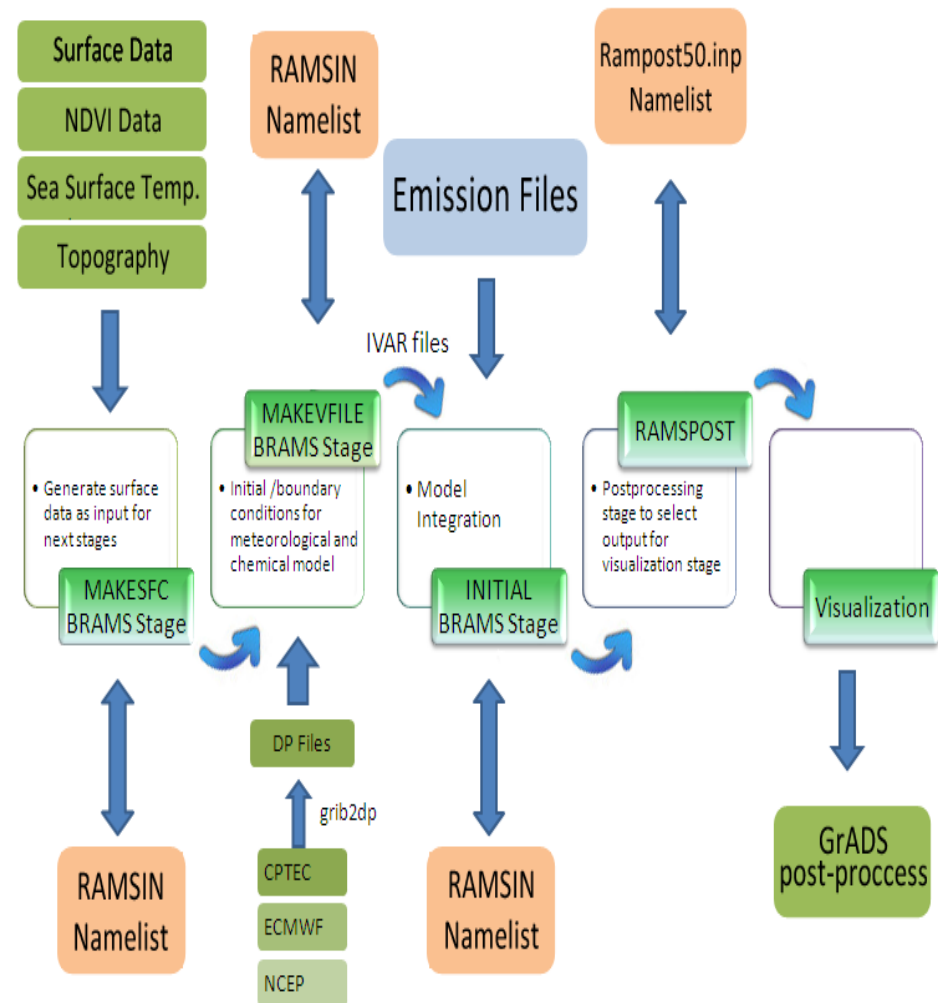


- Chemical Weather model:
- Requires HPC resources
- Difficult to use
- Some objectives:
 - Provide more reliable regional emission and climate change scenarios for South America
 - Implement regionally coordinated chemical weather forecast tools.
- Use CATT-BRAMS model for chemical weather forecast:
 - Needs great amount of computational power and a large amount of data
 - Grid technology use is a natural step to follow

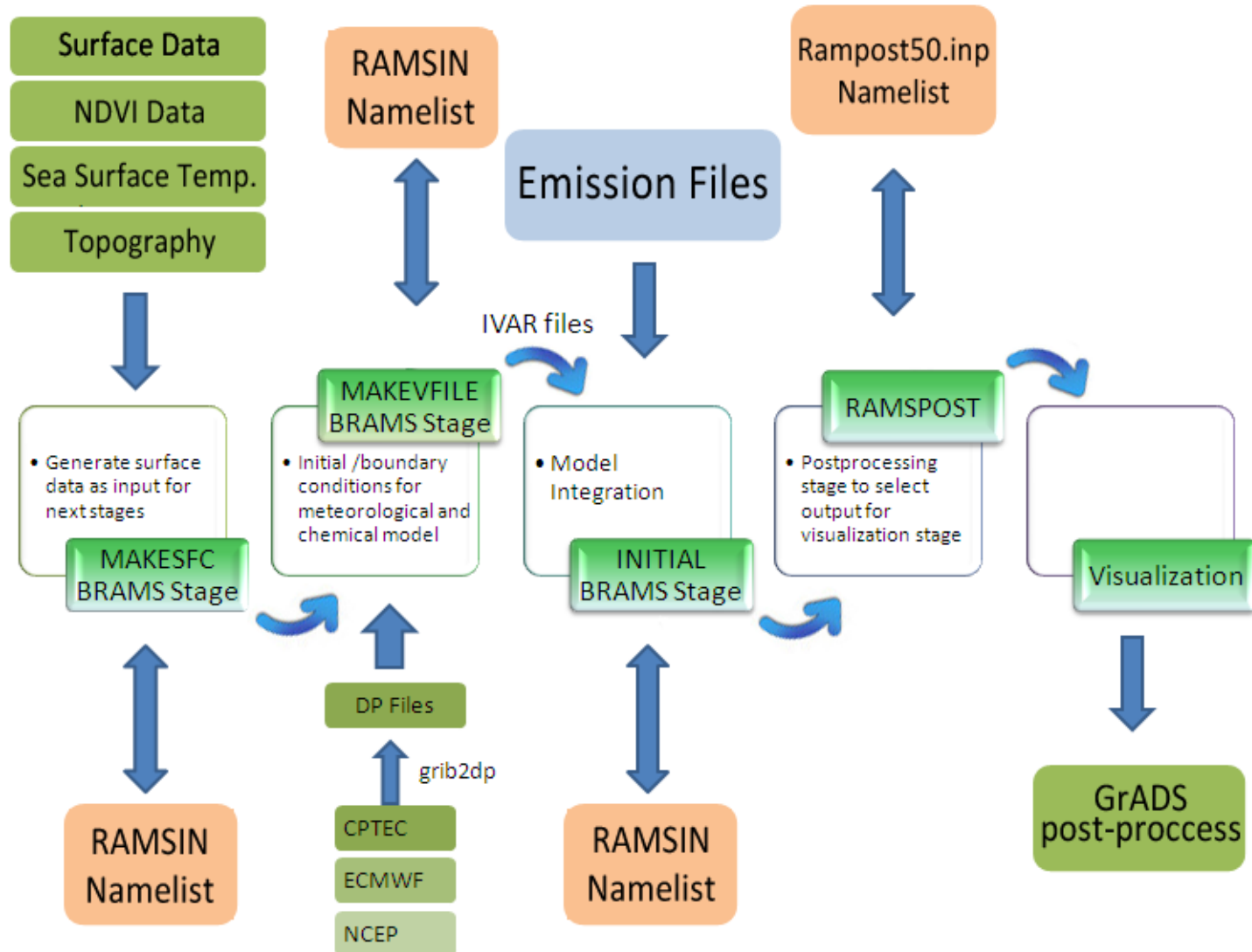


Chemical Weather Forecast

- **MAKESFC:** generate topography files and set domain for the simulation
- **MAKEVFILE:** Builds initial and boundary conditions for simulation
- **INITIAL:** Execution (serial or parallel) in meteorological or environmental mode. Environmental mode enables the emission, tracer and transport model.
- **Post-processing:**
 - **RAMSPOST :** file conversion from model output format (RALPH) to Grads format
 - **Visualization:** Grads generates a few diagnostic meteorological charts in order to know if the simulation has performed correctly



Grid Environment Execution

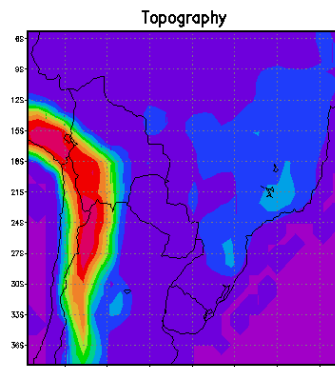


Result

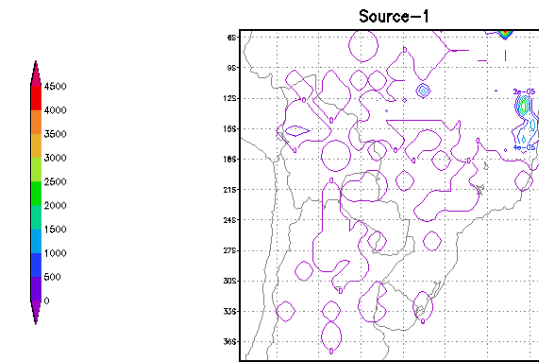


Analysis files

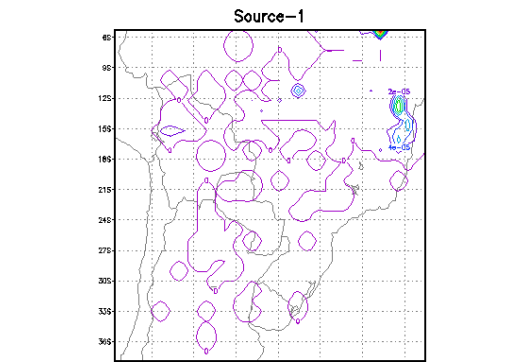
History files



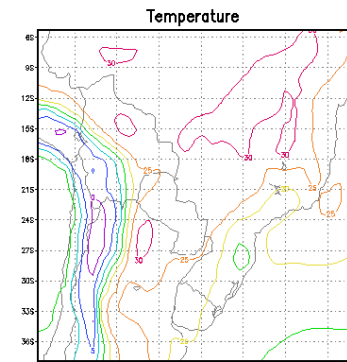
©2008 COLY/IES



2008-11-08-18:04



©2008 COLY/IES



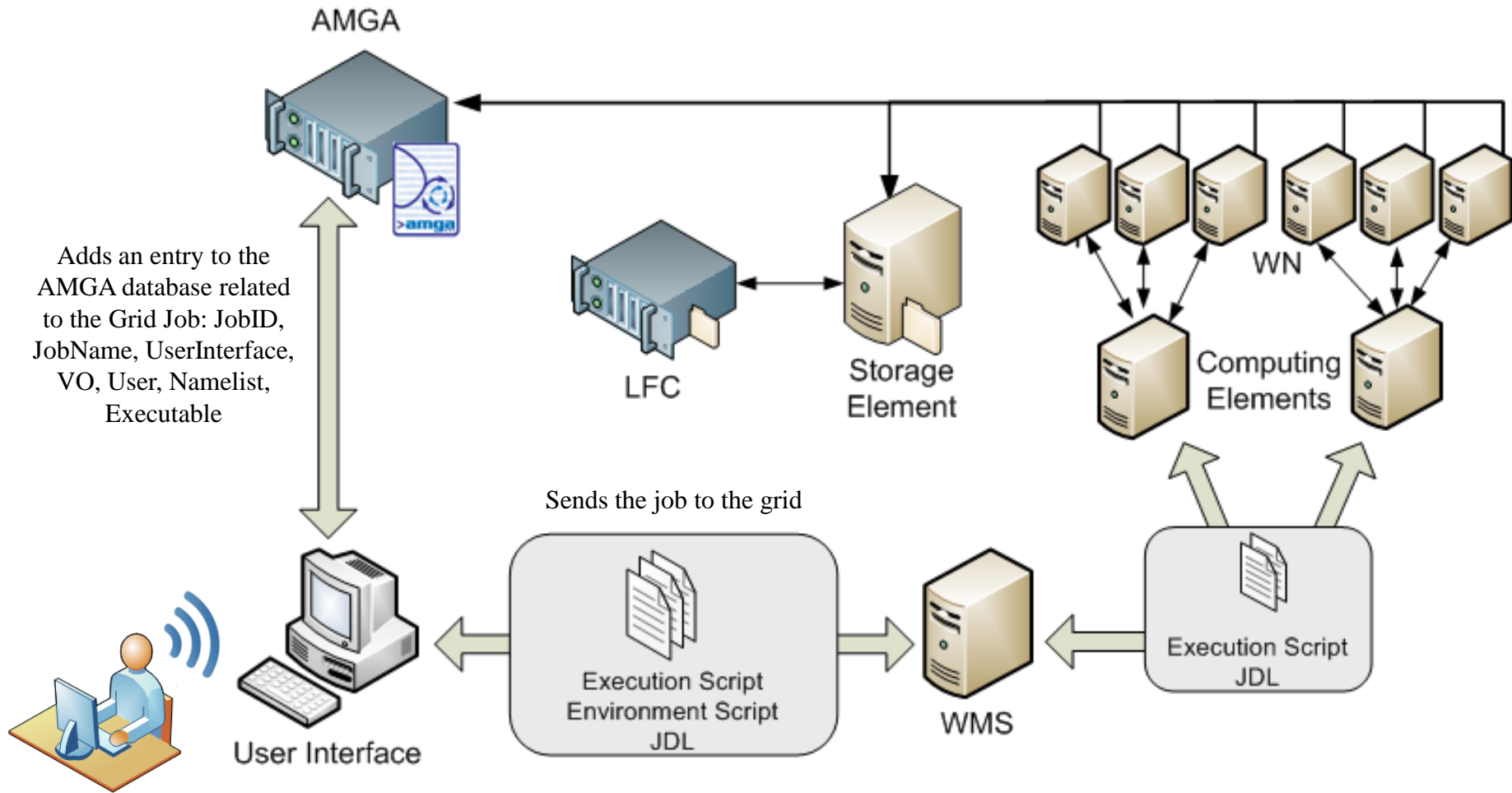
2008-11-08-18:04

©2008 COLY/IES

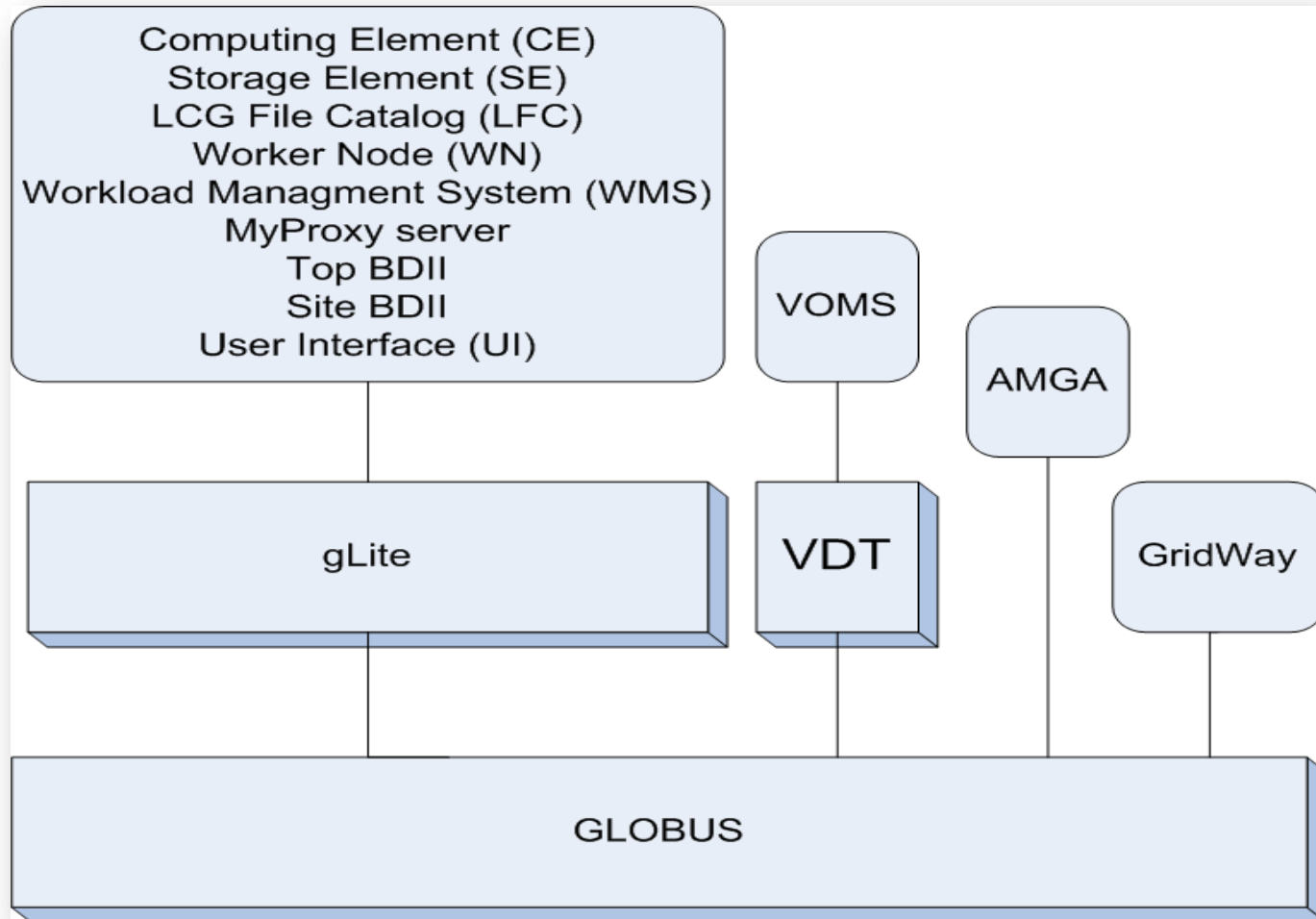
2008-11-08-18:04



Grid application implementation



Grid Services Infrastructure

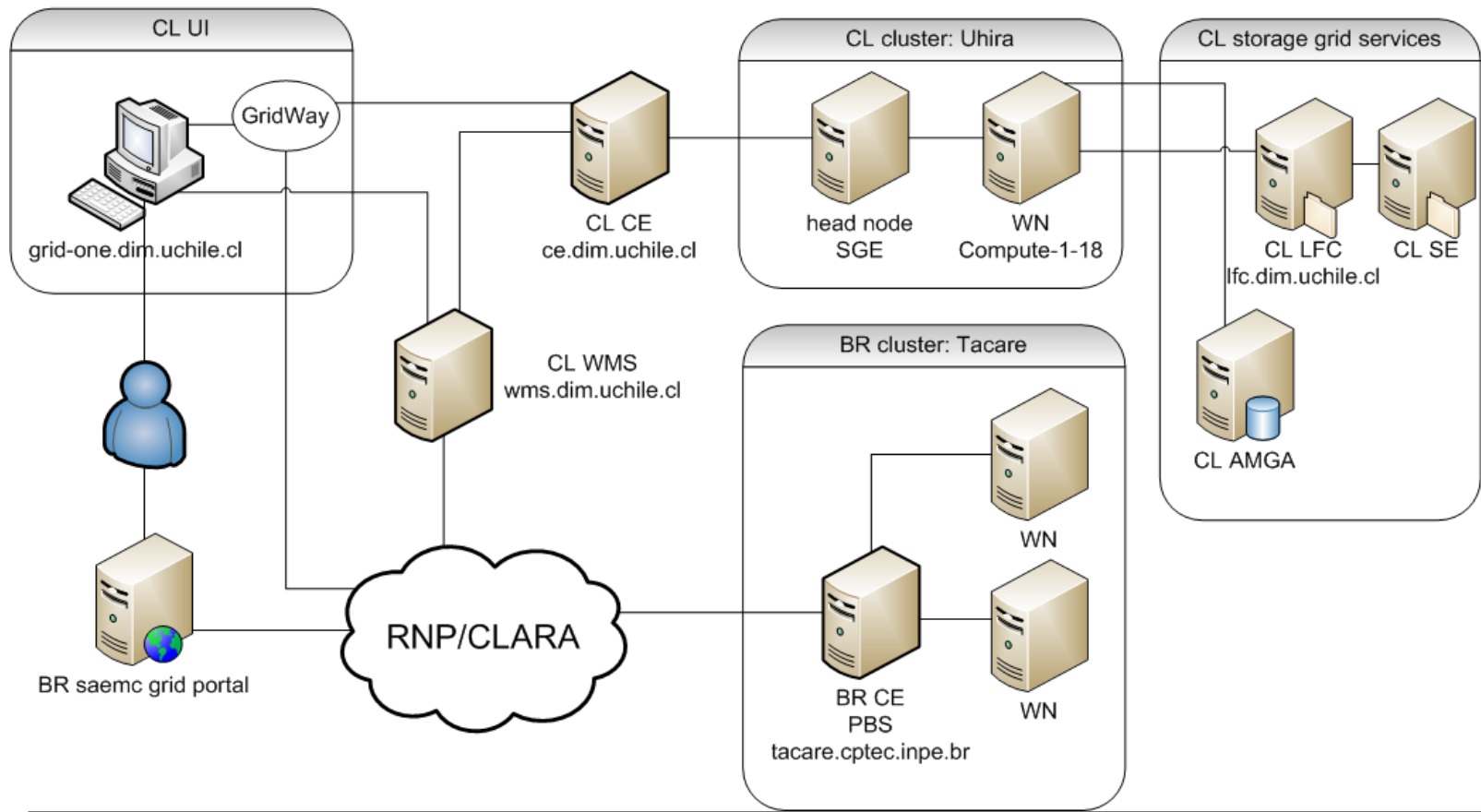


Grid middleware and services

Grid Services Infrastructure

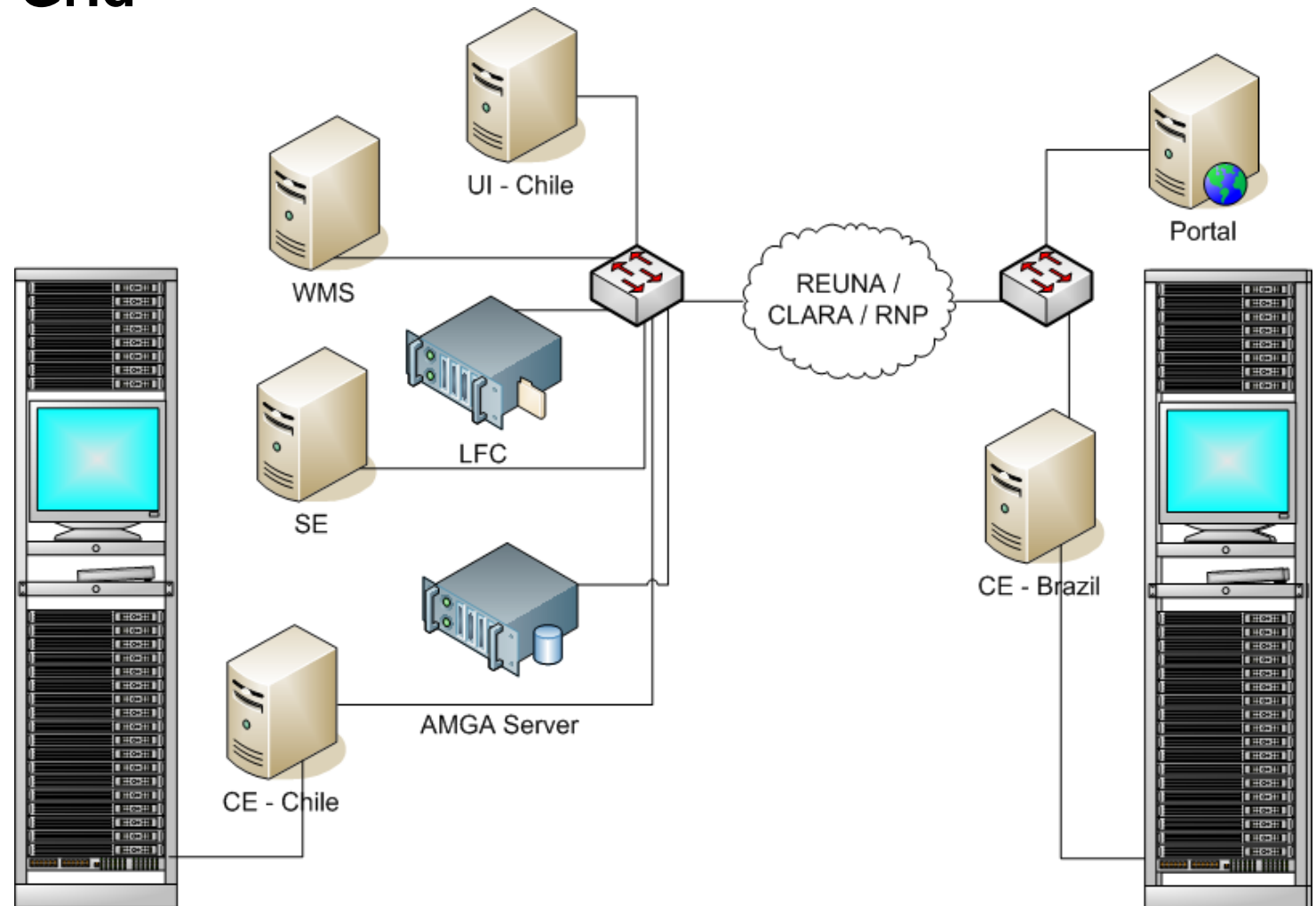


13/05/2010
GRID SERVICES VO saemc



Portal development and integration

SAEMC Grid





Network Connectivity





Connections and Circuits - Ipê Network (BR)

DWDM

-  10 GIGABITS
-  2.5 GIGABITS

SDH

-  622 MEGABITS
-  155 MEGABITS




PDH

-  257 MEGABITS
-  34 MEGABITS
-  20 MEGABITS
-  6 MEGABITS

Connections - REUNA Network (CH)



Switch Troncal GREUNA

-  155 Mbps
-  205 Mbps
-  310 Mbps

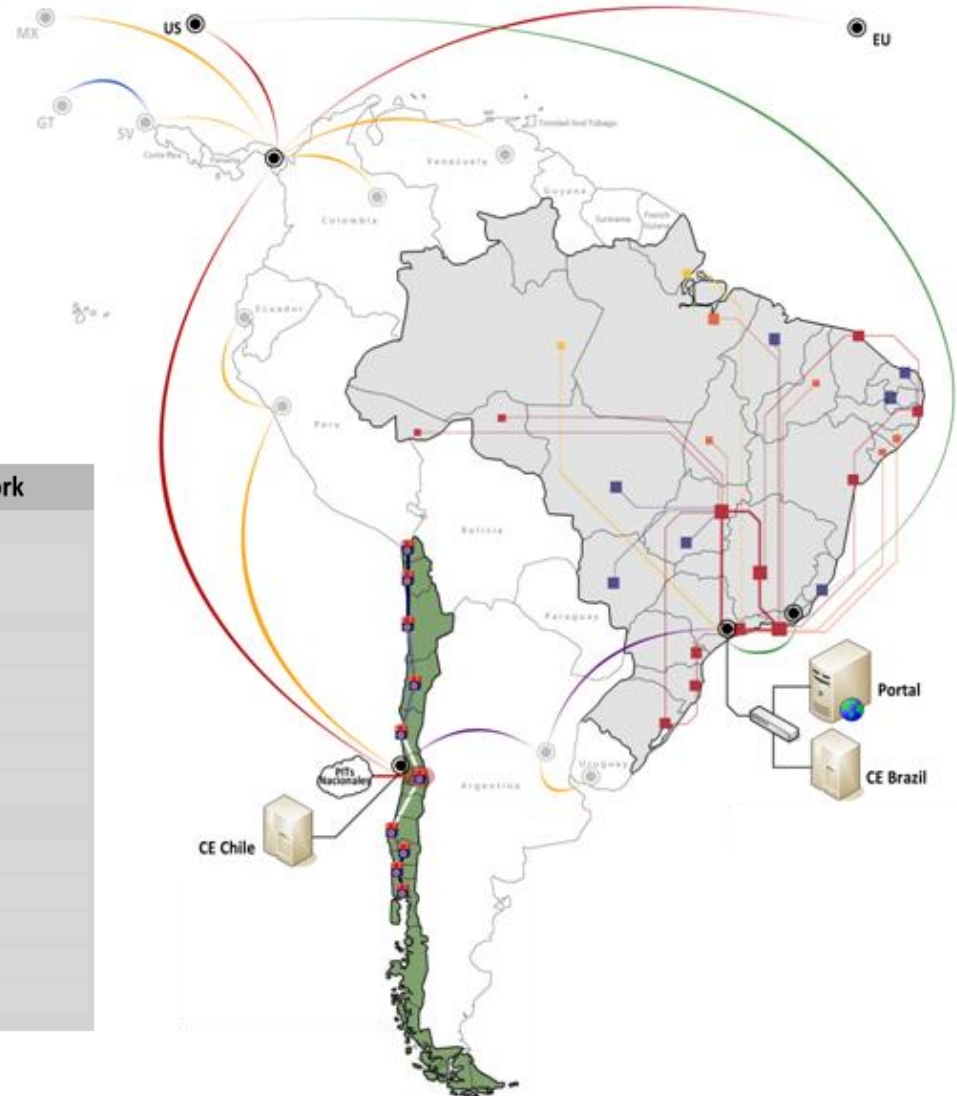
Connections - CLARA Network



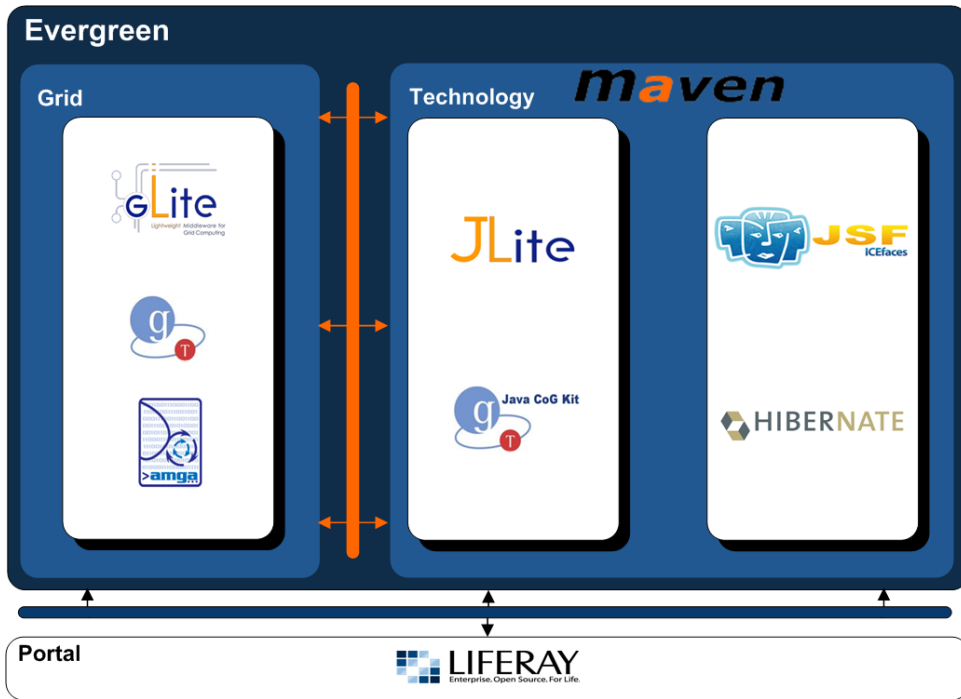
PoPs

-  10 Gbps
-  2.1 Gbps
-  1 Gbps
-  622 Mbps
-  155 Mbps

- US United States
- MX Mexico
- GT Guatemala
- SV El Salvador
- EU Europe



Portal development tools

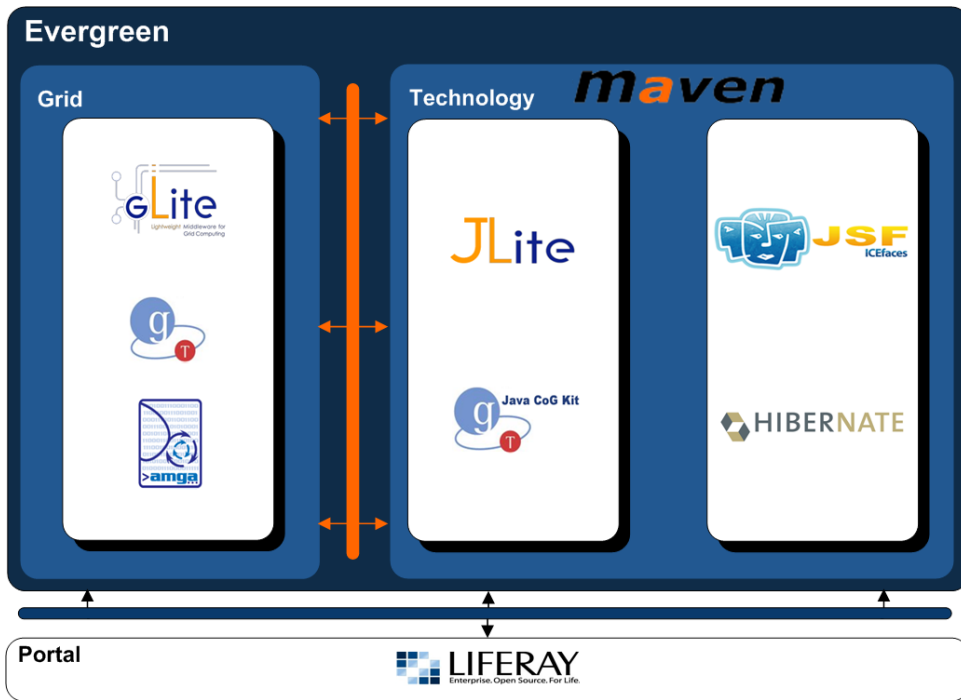


Liferay Portal is the open source enterprise portal solution, based in Java EE platform. It is a portlet container responsible for integrating all the available portlets and display them properly to users. Portlets are independent components used to provide content and informations in a portal.

Apache **Maven** is a software project management. Based on the concept of a Project Object Model. It can manage a project's build, reporting and documentation from a central piece of information.



Portal development tools



Hibernate facilitated the storage and retrieval of Java domain objects via Object/Relational Mapping.

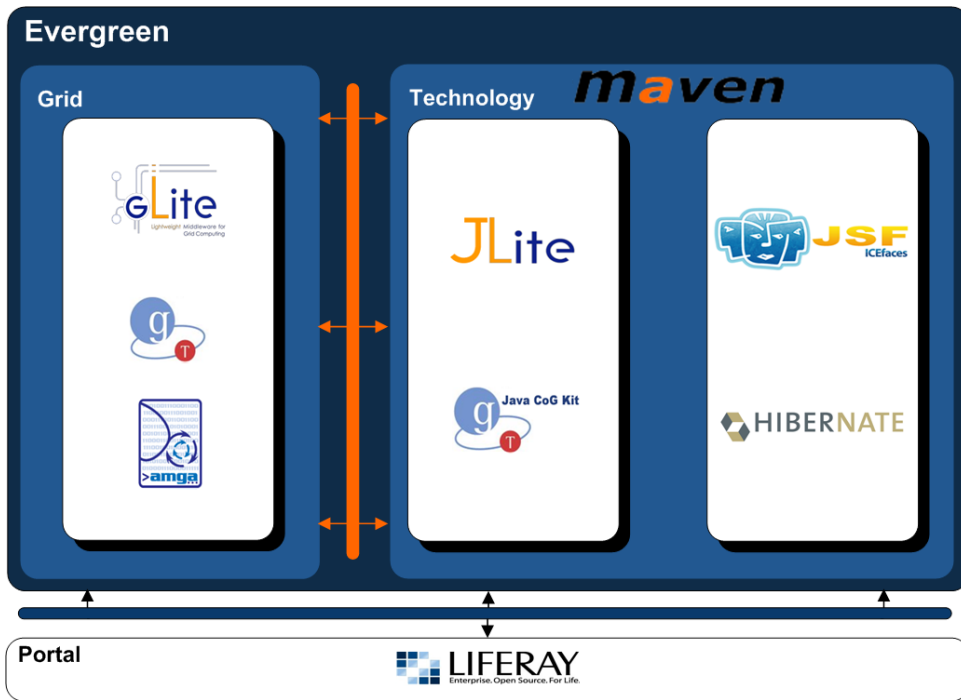
Facelets is an open source web framework under the Apache license and the default view handler technology for JavaServer Faces (JSF).

JavaServer Faces technology establishes the standard for building server-side user interfaces.

ICEfaces is more than a Ajax JSF component library, it's an Java EE Ajax framework for developing and deploying rich enterprise applications (REAs).



Portal development tools



jLite is a Java library providing simple API for accessing gLite based grid infrastructure. It is intended for Java developers who struggle with gLite middleware and want to reduce time and effort needed to build a cross-platform grid application on top of the EGEE grid infrastructure.

Java Commodity Grid (CoG) Kits is an API that provides important features of Globus Toolkit such as the implementation of GSI (Grid Security Infrastructure) based on Java, GridFTP and MyProxy. CoG Kit is used to provide credentials management within portal.

SAEMC Portal



South American Emissions, Megacities and Climate | SAEMC

Welcome Alexandre Oliveira!

Add Page

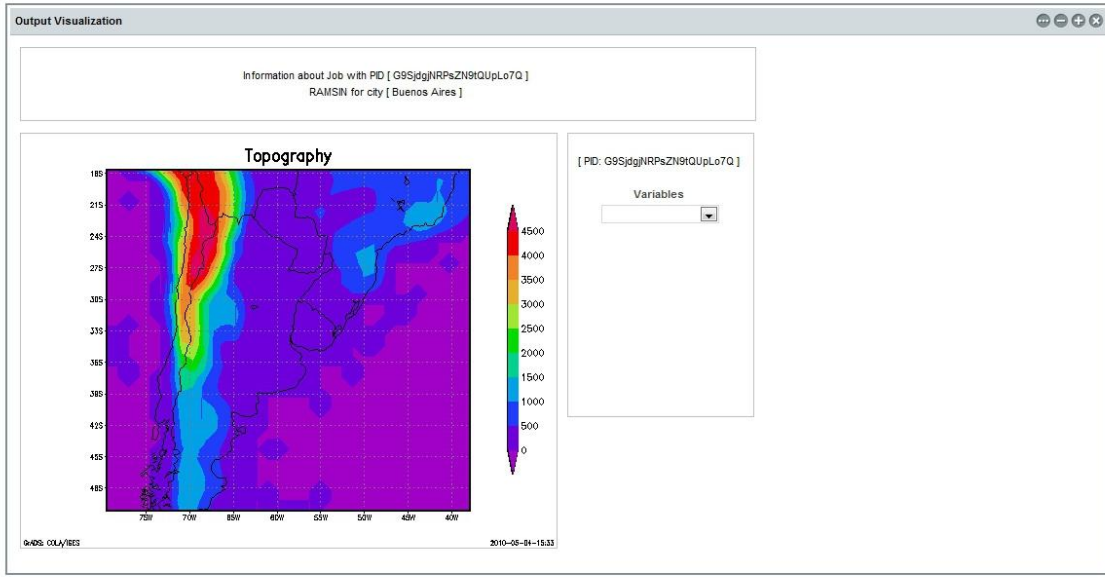
Create a job | Dashboard | Credential Manager | Grid Resources | Statistics

Dashboard

PID	RAMSIN	Computing element	Creation date	Submission date	Start of the execution	End of the execution	Job Status	Actions
ZY65w79E5tq9Nm0y9rS0A	Santiago		2010-05-10 07:13	2010-05-10 07:14			READY	[Icons]
29449	Rio de Janeiro		2010-05-10 07:12				CREATED	[Icons]
eJXfz08wVXlonoEap23A	Buenos Aires	ce.dim.uchile.cl	2010-05-08 07:09	2010-05-08 07:09	2010-05-08 08:43	2010-05-08 09:08	ACCEPTED	[Icons]
x2tVnaAXI2HBfMlu2kQ	Sao Paulo	ce.dim.uchile.cl	2010-05-05 05:26	2010-05-05 05:35	2010-05-05 06:22	2010-05-05 07:08	REJECTED	[Icons]
Kn_SE7eFyqWtB31YxAww	Buenos Aires	ce.dim.uchile.cl	2010-05-05 12:50	2010-05-05 12:50	2010-05-05 01:33	2010-05-05 02:14	CLEARED	[Icons]
G9SjdgjNRPsZN9tQUpl07Q	Buenos Aires	ce.dim.uchile.cl	2010-05-04 06:30	2010-05-04 06:30	2010-05-04 07:17	2010-05-04 07:59	CLEARED	[Icons]
QeU-p5TWQPRSRy8_5kXKg	Santiago	ce.dim.uchile.cl	2010-05-04 01:47	2010-05-04 12:43	2010-05-04 01:38	2010-05-04 02:23	CLEARED	[Icons]
msj0T7uFYXH0hNPBLCH5Q	Rio de Janeiro	tacare.cptec.inpe.br	2010-05-01 05:43	2010-05-01 05:44	2010-05-01 06:08	2010-05-01 07:14	CLEARED	[Icons]
4AbALf4G2_Ash_sxkVrm8A	Buenos Aires	tacare.cptec.inpe.br	2010-04-30 01:37	2010-04-30 02:03	2010-04-30 02:23	2010-04-30 03:39	CLEARED	[Icons]
Lntg05KQQ_kZpz9GSuotw	Sao Paulo	ce.dim.uchile.cl	2010-04-29 07:54	2010-04-29 07:55	2010-04-29 09:03	2010-04-29 09:48	CLEARED	[Icons]

10 jobs found, displaying 10 job(s), from 1 to 10. Page 1 / 1.

* The dates are showed in the GMT format



Credential Management



Credential Manager

Your credentials | Your certificate

Refresh list | New credential | Delete credential

Dn	Status	Time remaining
C=BR,O=ICPEDU,O=UFF BrGrid CA,O=INPE,OU=CPTEC,CN=Julio Cezar Goncalves de Freitas,CN=proxy,CN=proxy,CN=proxy,CN=proxy	Active	11 hours 59 minutes 36 seconds

DN: C=BR,O=ICPEDU,O=UFF BrGrid CA,O=INPE,OU=CPTEC,CN=Julio Cezar Goncalves de Freitas,CN=proxy,CN=proxy,CN=proxy,CN=proxy

Status: **Active**

Remaining lifetime: 11 hours 59 minutes 36 seconds

Creation date: Thu Apr 01 14:53:32 GMT 2010

End date: Thu Apr 08 14:58:31 GMT 2010

Retrievers:

User name: /C=BR/O=ICPEDU/O=UFF BrGrid CA/O=INPE/OU=CPTEC/CN=Julio Cezar Goncalves de Freitas

Lifetime: 11 hours 59 minutes 36 seconds



CATT-BRAMS parameters definitions



Create a Job

Cities: Sao Paulo

Date: 05/04/10

Load Create Job

MODEL_GRIDS MODEL_FILE_INFO MODEL_OPTIONS MODEL_SOUND MODEL_PRINT CATT_INFO TEB_SPM_INFO ISAN_CONTROL ISAN_ISENTROPIC

IPSFLG: 1,

ITSFLG: 0,

IHORGRAD: 2,

IUSFLG: 0,

HS: 0.,

PS: 1010.,1000.,2000.,3000.,4000.,6000.,8

TS: 25., 18.5, 12., 4.5, -11., -24., -37., -56

RTS: 70.,70.,70.,70.,20.,20.,20.,20.,10.,10.,1

US: 10.,10.,10.,10.,10.,10.,10.,10.,10.,10.,1

VS: 0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,0.,



Job submission / control



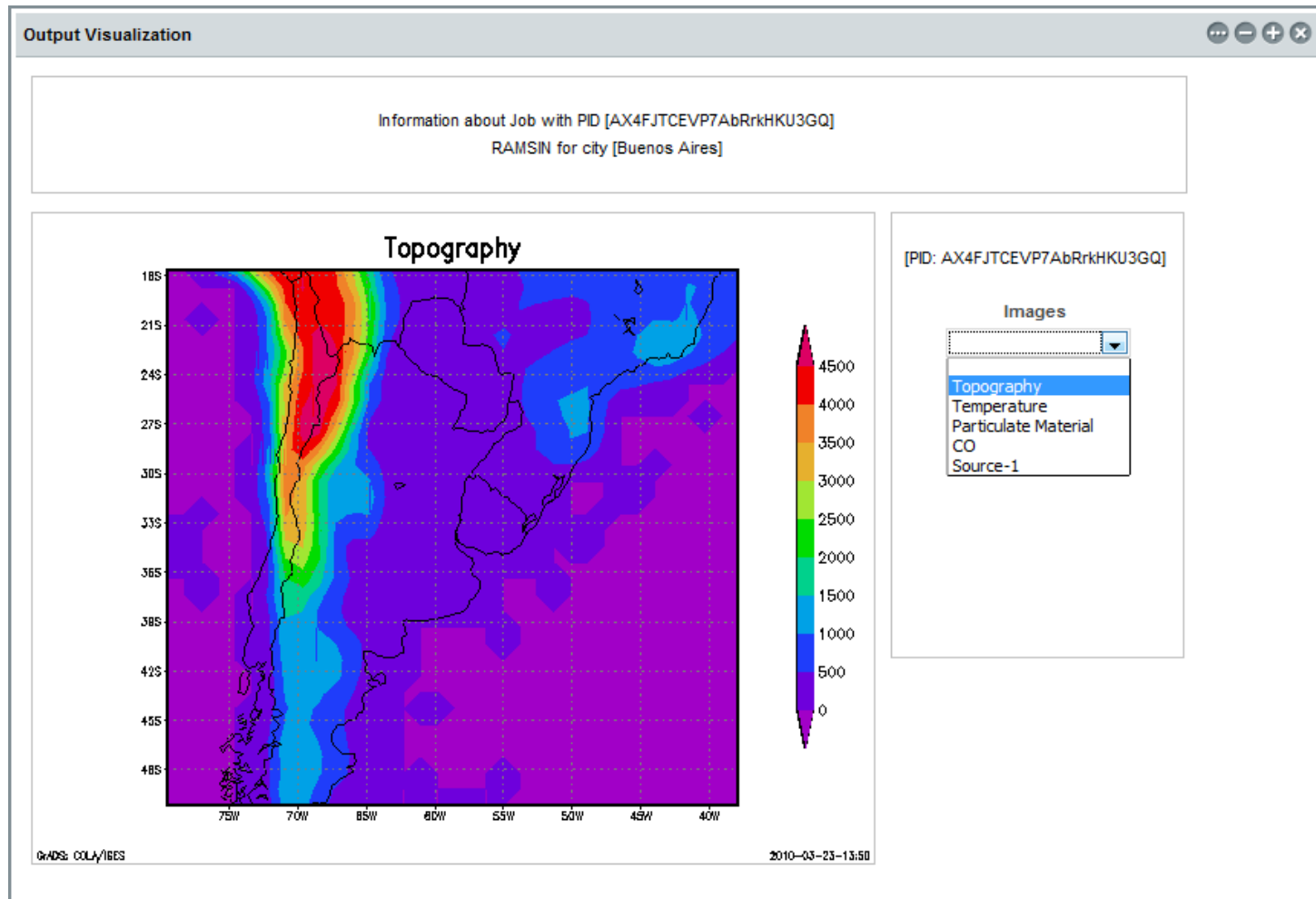
Dashboard ... - + x

PID	RAMSIN	Creation date	Submission date	Start of the execution	End of the execution	Job Status	Actions
27719	Santiago	2010-04-02 12:44:25 GMT				READY	
2sXfy8zHB-YzH8-SSTckkA	Santiago	2010-03-26 06:12:38 GMT	2010-03-26 06:16:00 GMT	2010-03-26 06:46:10 GMT	2010-03-26 07:38:36 GMT	DONE	
31169	Santiago	2010-04-01 05:29:31 GMT				READY	
70950	Buenos Aires	2010-04-01 06:51:11 GMT				READY	
94332	Sao Paulo	2010-04-01 07:54:25 GMT				READY	
aQy4YMStN27rAEmS5OXzXw	Santiago	2010-03-21 07:11:39 GMT	2010-03-22 05:37:29 GMT	2010-03-22 05:48:46 GMT	2010-03-22 06:00:47 GMT	DONE	
AX4FJTCEVP7AbRrkHKU3GQ	Buenos Aires	2010-03-23 04:49:24 GMT	2010-03-23 05:23:33 GMT	2010-03-23 05:33:55 GMT	2010-03-23 06:08:37 GMT	CLEARED	
btjMPbKQJwhjMLotRN1Ydg	Santiago	2010-03-20 04:31:48 GMT	2010-03-22 07:26:23 GMT	2010-03-22 07:34:37 GMT	2010-03-22 08:15:04 GMT	DONE	
cyqOFBdZ3bs3O3j_mSfrUA	Sao Paulo	2010-03-21 05:56:36 GMT	2010-03-23 12:07:46 GMT	2010-03-23 12:16:36 GMT	2010-03-23 01:51:25 GMT	REJECT	
DkN6RZtbVq4okst83rHfaA	Santiago	2010-03-22 10:20:19 GMT	2010-03-22 10:21:47 GMT	2010-03-22 10:33:56 GMT	2010-03-22 11:58:52 GMT	ACCEPTED	

21 jobs found, displaying 10 job(s), from 1 to 10. Page 1 / 3.



Visualization



Computing Element rank



List CE

Computing Elements	Rank
tacare.cptec.inpe.br:2119/jobmanager-lcgpbs-saemc	18
ce.dim.uchile.cl:2119/jobmanager-lcgsge-saemc	2



Conclusion



- We have a working grid between CMM and CPTEC.
- Installation/Configuration/Tests of grid services is not easy.
- We faced Communication problems that will be solved soon with a better connectivity of CMM cluster to RNP/CLARA.
- Thanks to grid integration with other VOs, The CATT-BRAMS job ran successfully in many grid sites around the world and Chile grid site has been certified by IGALC.
- For the portal version 2, we need to install and tests storage grid services clients on Brazil cluster.



“Pros” of the Grid approach



- Distributed computing power leads to cooperation at several levels, technical and scientific as example.
- Can re-utilize more efficiently the aging existing infrastructure, sharing computing time among the community.
- Can leverage the use of existing networking.
- Can bring focus on the area of expertise of the scientific, how the is the simulation/work is done is completely transparent.



Next Steps



- Include:
 - Date/time/level selection for visualization
 - Parameters definition
 - Graphical area selection
 - Features discussed with SAEMC community





Thank you!

Contact: eugenio.almeida@cptec.inpe.br

