

# International ICFA Workshop on HEP Networking, Grid and Digital Divide Issues for Global e-Science

October 9-11, 2006  
Cracow, Poland

## Agenda

- e-Science (HEP) strategies at different continents
- regional initiatives on networking and Grid computing
- national Grids and related projects

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International Committee  
on Future Accelerators  
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on International Connectivity

8-11 October 2006



# Latin America and Digital Divide

Alberto Santoro  
UERJ/Brazil

## Outline

- I - Introduction
- II - L.A. News
- III - HEPGRID Brasil
- IV - Conclusion

# I - Introduction

- The progress in Computing in Latin America is visible when we visit sites of National and Regional Networks. Unfortunately not homogeneous. In Brazil there is a big effort made by RNP to extend the network to all country

Digital Exclusion in Latin America including Brazil it is a complicated situation due the big Social Differences!

- As we know, GRID is a Good, Modern and Efficient Computing architecture. This technology is pushing the Progress. Good and large bandwidths is an important component of definition of GRID.
- The way that we have followed was The cooperation. This is a tradition in HEP collaborations.

- It is very difficult to get information from L. A. countries on the domain of GRID and/or Network.
- This shows us the stage of the development of computing and science.
- We will try to summarise the present situation that is moving not so fast as we want but there are some relevant progress.
- First initiatives for HEP, came from Leon Lederman on the 80's, (ACPs...) continued now by Harvey Newman (AMPATH, CHEPREO,...).
- Thanks to RNP (Rede Nacional de Pesquisas –Brasil) in particular to Dr. Michael Stanton I got many information about the situation on the region.





# II - Latin America News on Network Developments



## The ALICE project [www.dante.net/alice](http://www.dante.net/alice)

America Latina Interconectada Con Europa

- The main objective of ALICE was set up in 2003 to develop RedCLARA. The budget of 12.5 M€, including CE contribution of 10 M€ and 2.5 M€ from LA partners.

## Targeted Countries

Argentina (AR)

Brazil (BR)

Bolivia (BO) †

Chile (CL)

Colombia (CO)

Costa Rica (CR)

Cuba (CU) †

Ecuador (EC)

El Salvador (SV)

coordinated by DANTE, participation of 4 EU NRENs targeted countries in LA (see [www.dante.net/alice](http://www.dante.net/alice))

Guatemala (GT)

Honduras (HN) †

Mexico (MX)

Nicaragua (NI)

Panama (PA)

Paraguay (PY) †

Peru (PE)

Uruguay (UY)

Venezuela (VE)

† *country not yet  
connected to  
RedCLARA*

# RedCLARA and Latin America

## Cooperación Latino Americana de Redes Avanzadas

- Achievements of RedCLARA:
  - facilitates collaboration within LA and between EU and LA
    - more than 700 universities in LA and 3500 in EU
    - Many sites for scientific research, especially in geo- and astrophysics, climate, oceanography, biodiversity, environmental and human cultures

### RedCLARA sustainability

- RedCLARA deployment has depended heavily on the 80% financing provided by EuropeAid
- Many connections to RedCLARA coming from mid-2005
- ALICE Project lifetime currently expected to terminate in March, 2007 (+ a few months)

To maintain the current int. connectivity after March, 2007, of interest both to LA and EU, has been discussed at the highest political levels

- April 2006 (EU-LAC ministerial forum, Lisbon)
- May 2006 (EU LAC summit of heads of state and heads of government, Vienna)

## NRENs in LA before ALICE

### National Research and Education Networks

- With R&E connections: AR, BR, CL, MX, VE
- With connectivity: Costa Rica, Cuba, Uruguay

Cooperation with, initiatives of FIU



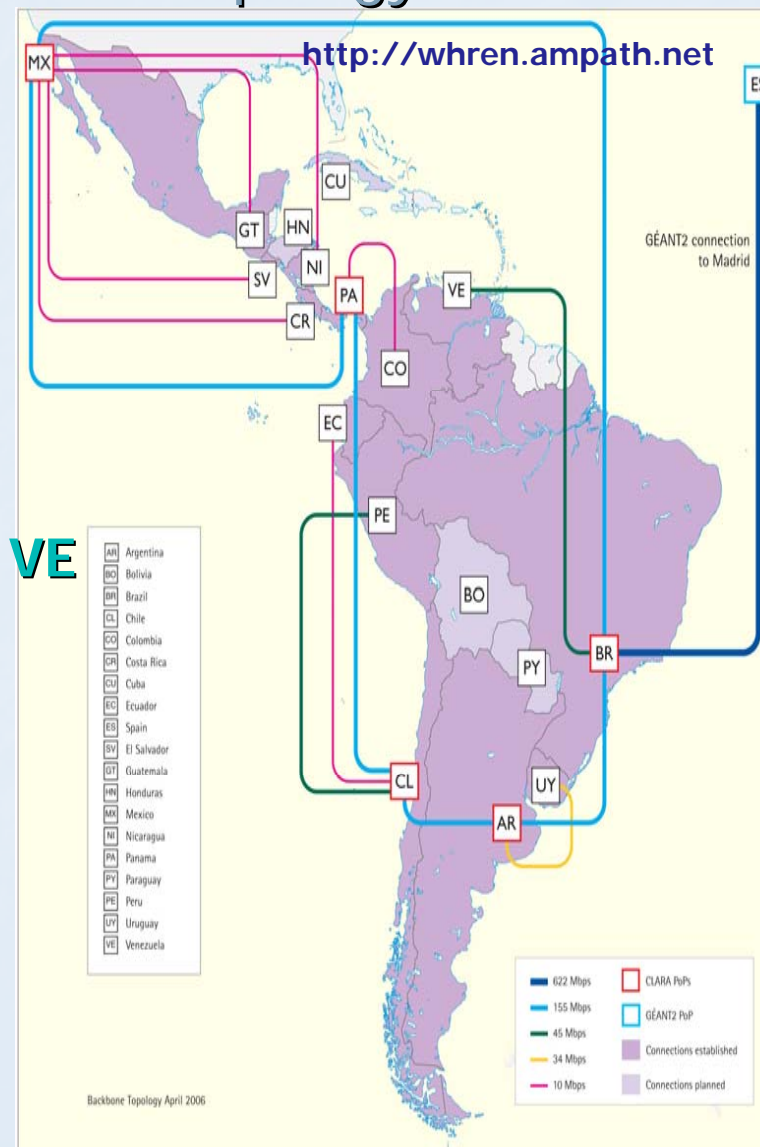
Western Hemisphere Research and Networking

Links Interconnecting Latin America

Alberto Santoro

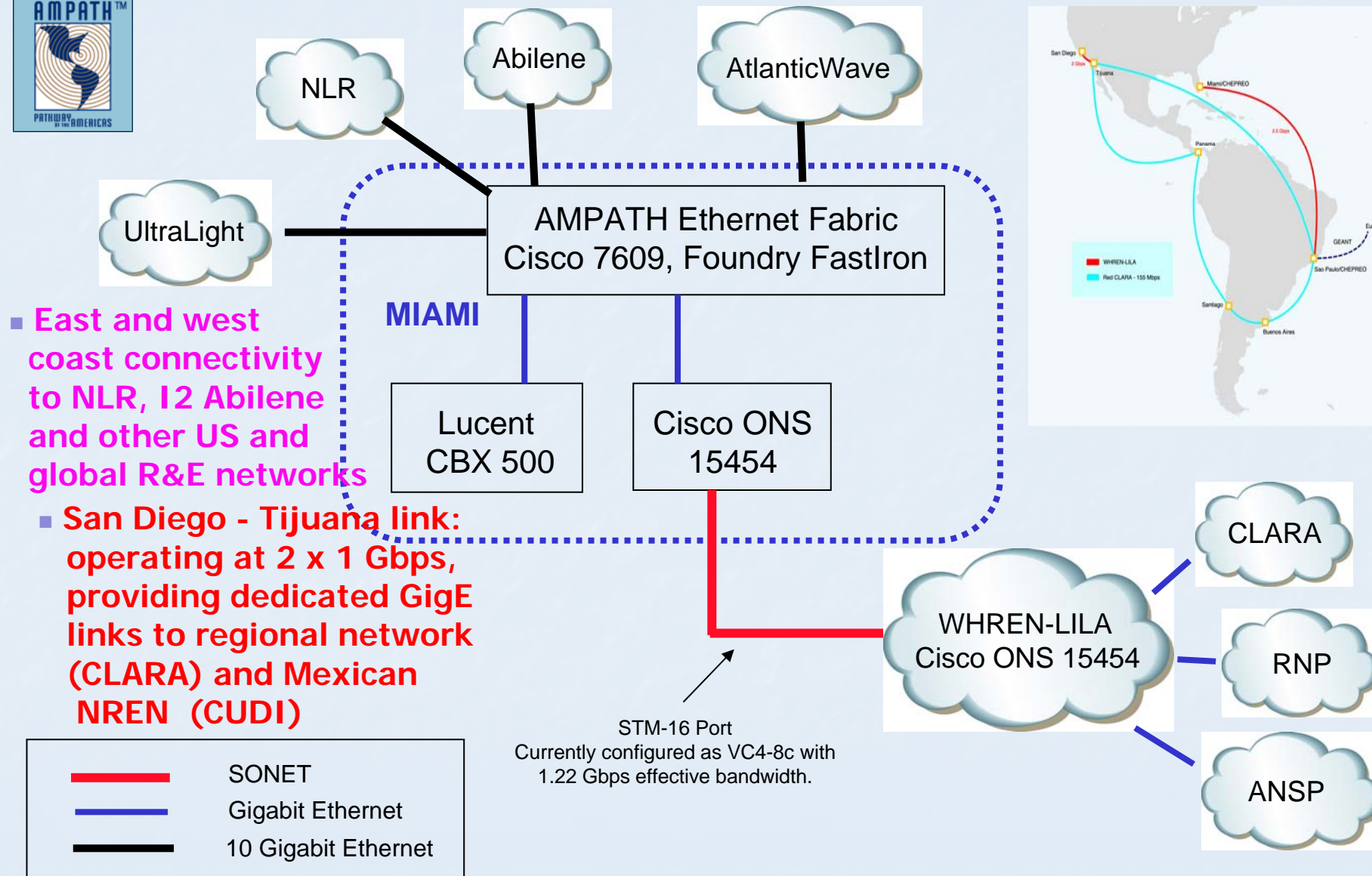
8-11 October 2006

## topology –2006



# AMPATH International Exchange Point

Links Interconnecting Latin America

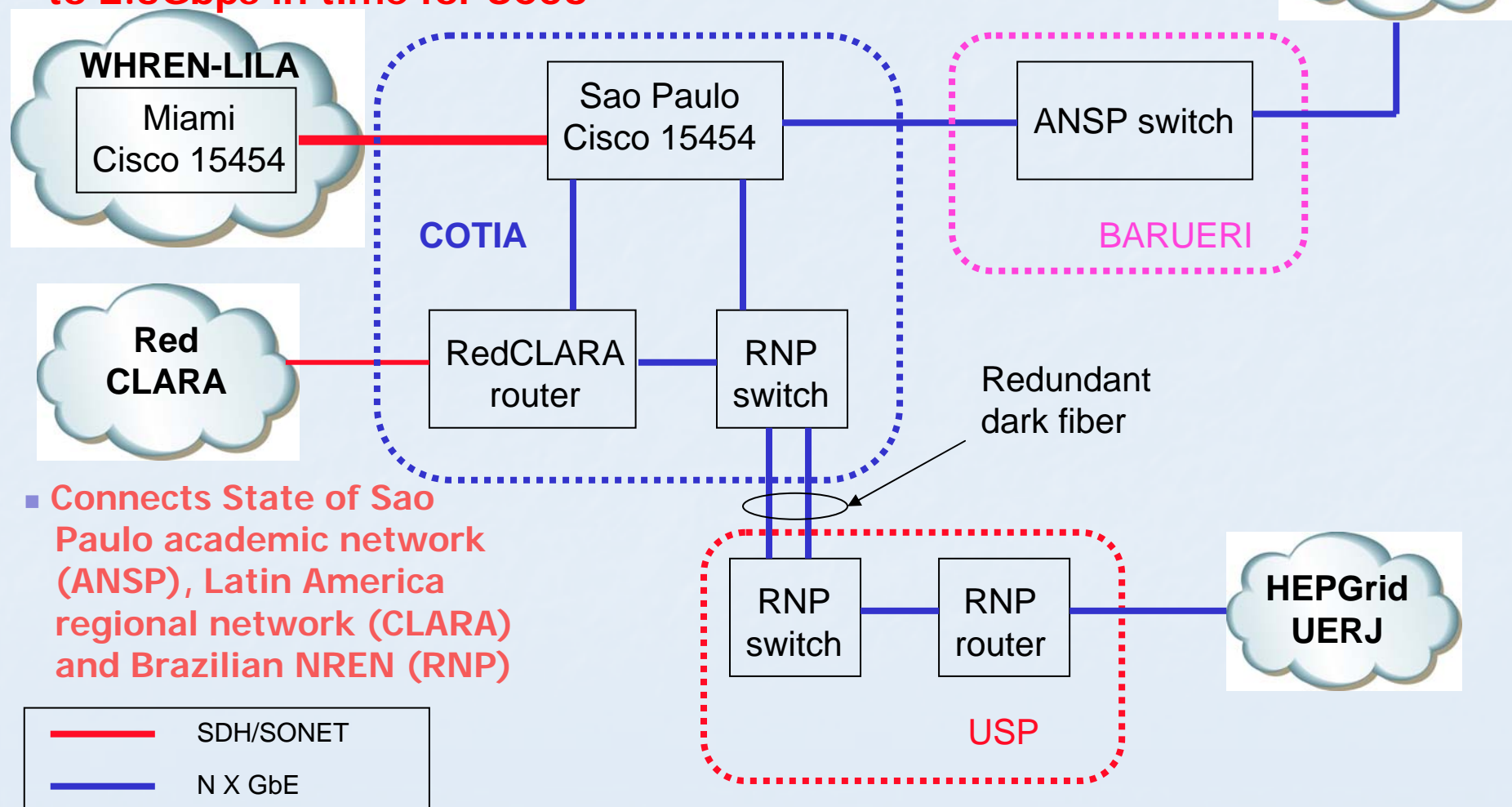




# Sao Paulo Distributed Exchange Point

Sao Paulo has become a distributed exchange point, interconnecting ANSP, CLARA, RNP, supporting a distributed CMS Tier-2 facility, with inter-regional connections to U.S. R&E networks and E.U.

- Miami - Sao Paulo link:** GEANT  
**STM-16 at 1.2Gbps. Increasing to 2.5Gbps in time for SC06**



## EELA NRENs in Latin America

E-Infraestrutura shared between Europe and Latin America

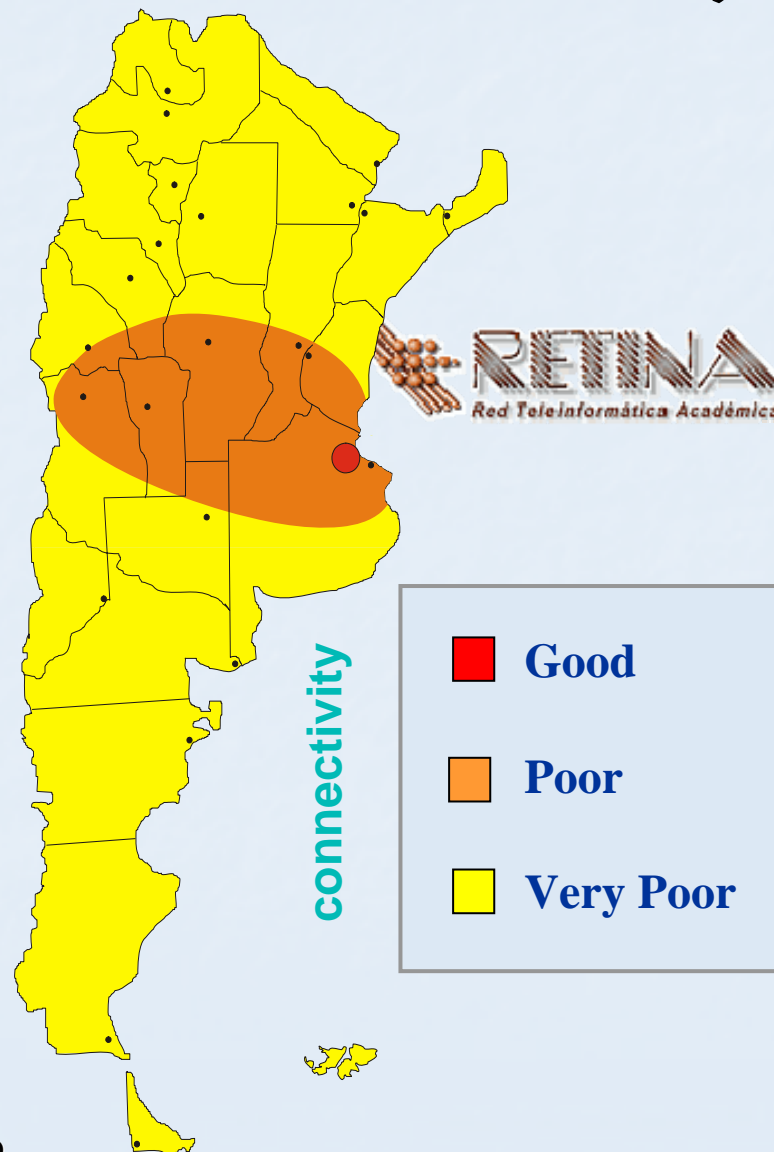
- RedCLARA interconnects the NRENs ( National Research and Education Networks) of 14 countries in LA.
- They can be classified into 3 categories:
  - "old" NRENs (i.e. those predating CLARA)  
Argentina, Brazil, Chile, México, Venezuela
  - "new" NRENs (i.e. created after CLARA)  
Peru, Colombia (CO not EELA, but interested in grids)
  - Unconnected NRENs: Cuba

# Status of Some NRENs in LA (National Research and Education Networks)

## Argentina: RETINA

<http://www.retina.ar>

- Red Teleinformática Académica
- Membership organisation
- Connects to RedCLARA  
(contract b/w is 90 Mbps)  
through PoP-AR in Buenos Aires

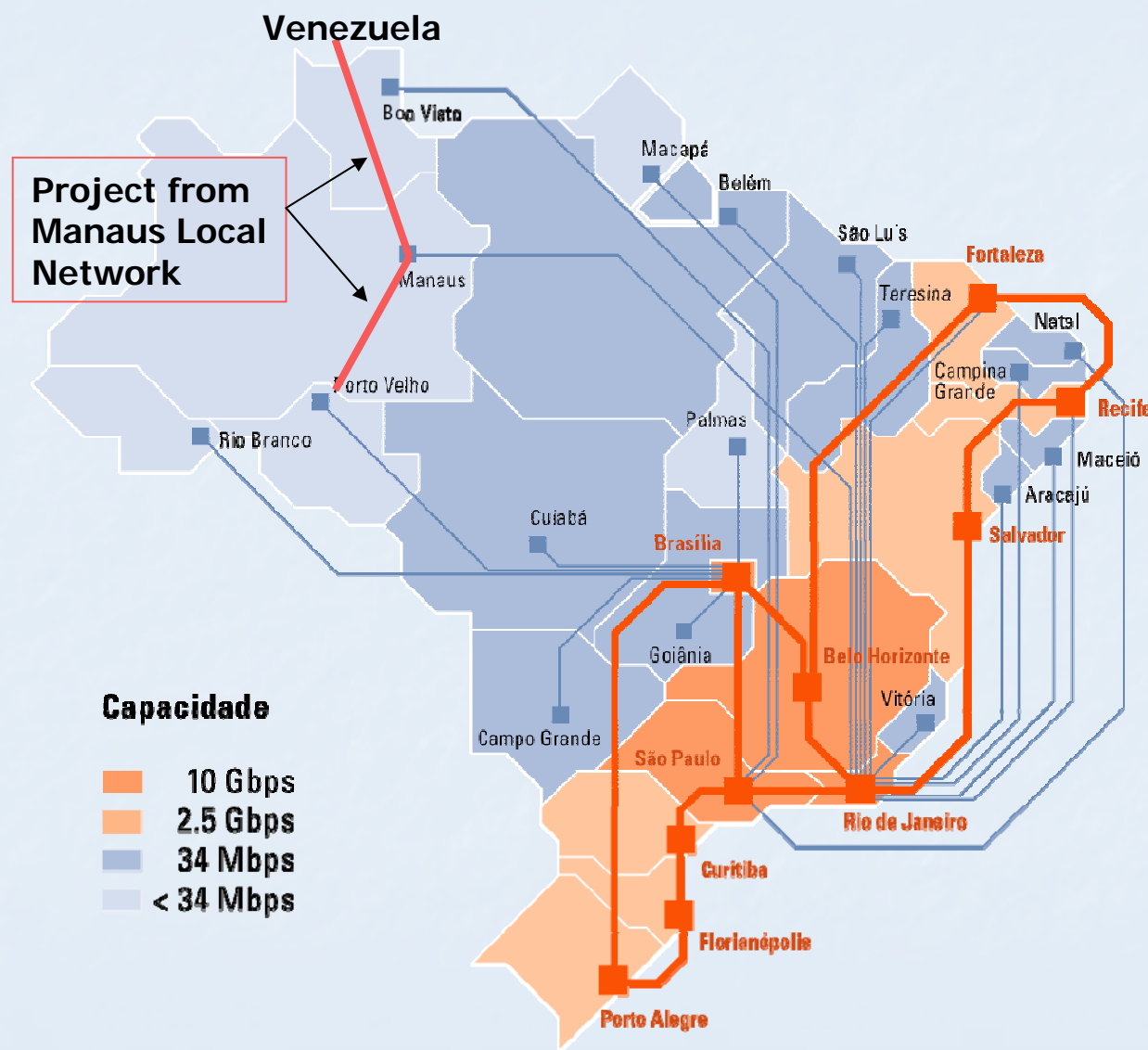


- **Rede Nacional de Ensino e Pesquisa**  
**Private non-profit company contracted by Brazilian government to operate and develop national network.**
- **Network use without charge for qualified connectors (higher education and research).**
- **National backbone (up to 10 Gbps) provides connectivity to all state capitals**
- **Access bandwidth up to 1 Gbps**
- **Access to RedCLARA (155 Mbps) at PoP-BR in S. Paulo**
  1. **Project GIGA – an optical networking testbed**
  2. **IPÊ – Innovation, Research and Education**
  3. **Redecomep -Rede Optical Comunitária Metropolitan Networks**





## New Projects Topology



**Connections to all 26 state capitals and Brasília:**

**Network core (12,000 km):**

- 10 Gbps to 4 capitals
- 2.5 Gbps to 6 capitals

**Access links**

- 34 Mbps to 11 capitals
- < 34 Mbps to 6 capitals

<http://www.redecomep.rnp.br>

**REDECOMPEP**

Redes Comunitárias de Educação e Pesquisa com capacidade virtualmente ilimitada

## Optical Metropolitan Networks for the R&E community

Página inicial

O que é

Downloads

Vídeos

Notícias

Na mídia

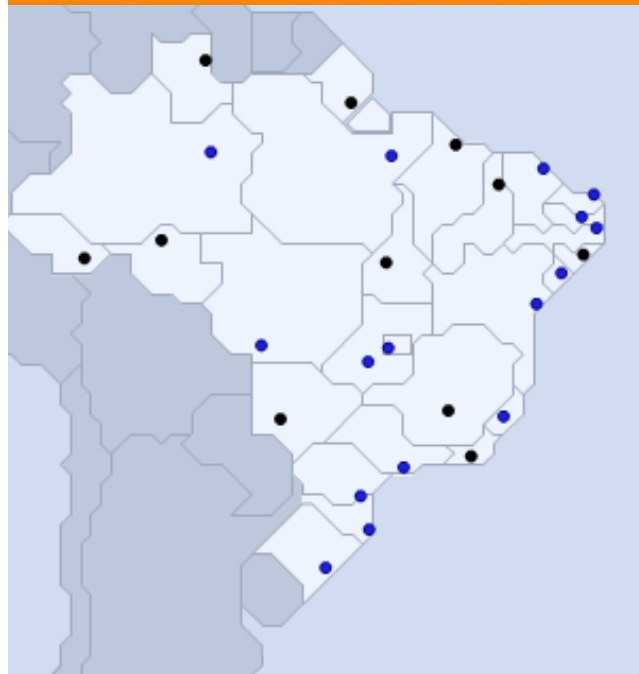
Contatos

Área restrita



**REDES METROPOLITANAS**

**A INICIATIVA**



REDECOMPEP is an initiative of Ministry of Science and Technology (MCT) coordinate by RNP which purpose is to create Metropolitan high speed networks based on its own Optical Fibers, to serve the research institutions and Universities via Consortia among the participant Institutions to assure the auto-support.

- Cities that already signed the MoU.....16
- Participant Institutions.....228
- Investment in own fiber until now....R\$13M ~ 6M\$US
- coverage estimate.....650 Km
- Investment in equipment until now...R\$10M ~ 4.5M\$US

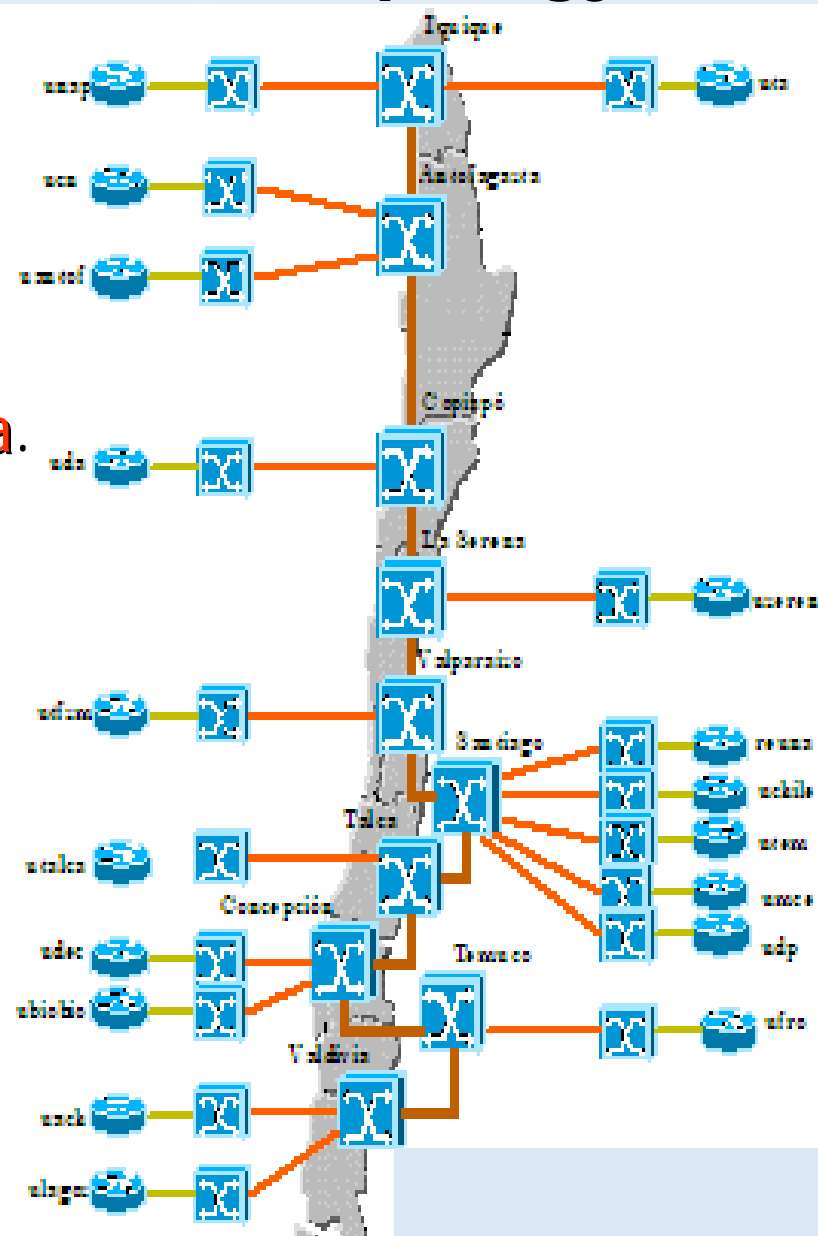
Manaus, Belém, Fortaleza, Natal, Recife, Salvador, Vitória, Brasília, Curitiba, Florianópolis, Porto Alegre



# topology



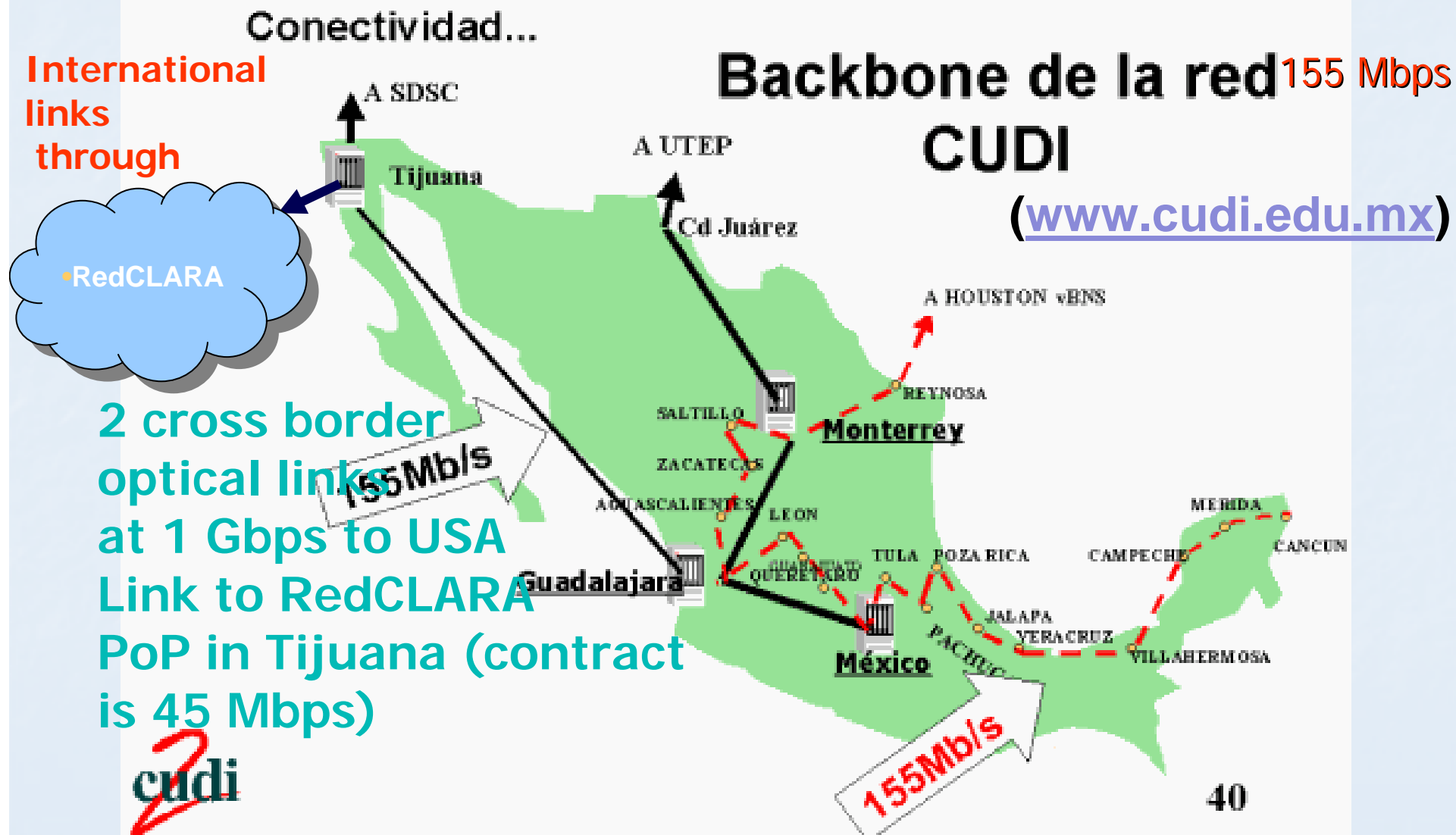
- Red Universitária Nacional
- Membership organisation
- 155 Mbps backbone runs north-south from Arica to Valdivia.
- Connects to RedCLARA (contract b/w is 90 Mbps) at PoP-CL in Santiago
- Members connect to backbone and contract international transit bandwidth through REUNA



# CUDI: topology

Corporación Universitaria para el

Desarrollo del Internet → Membership organisation







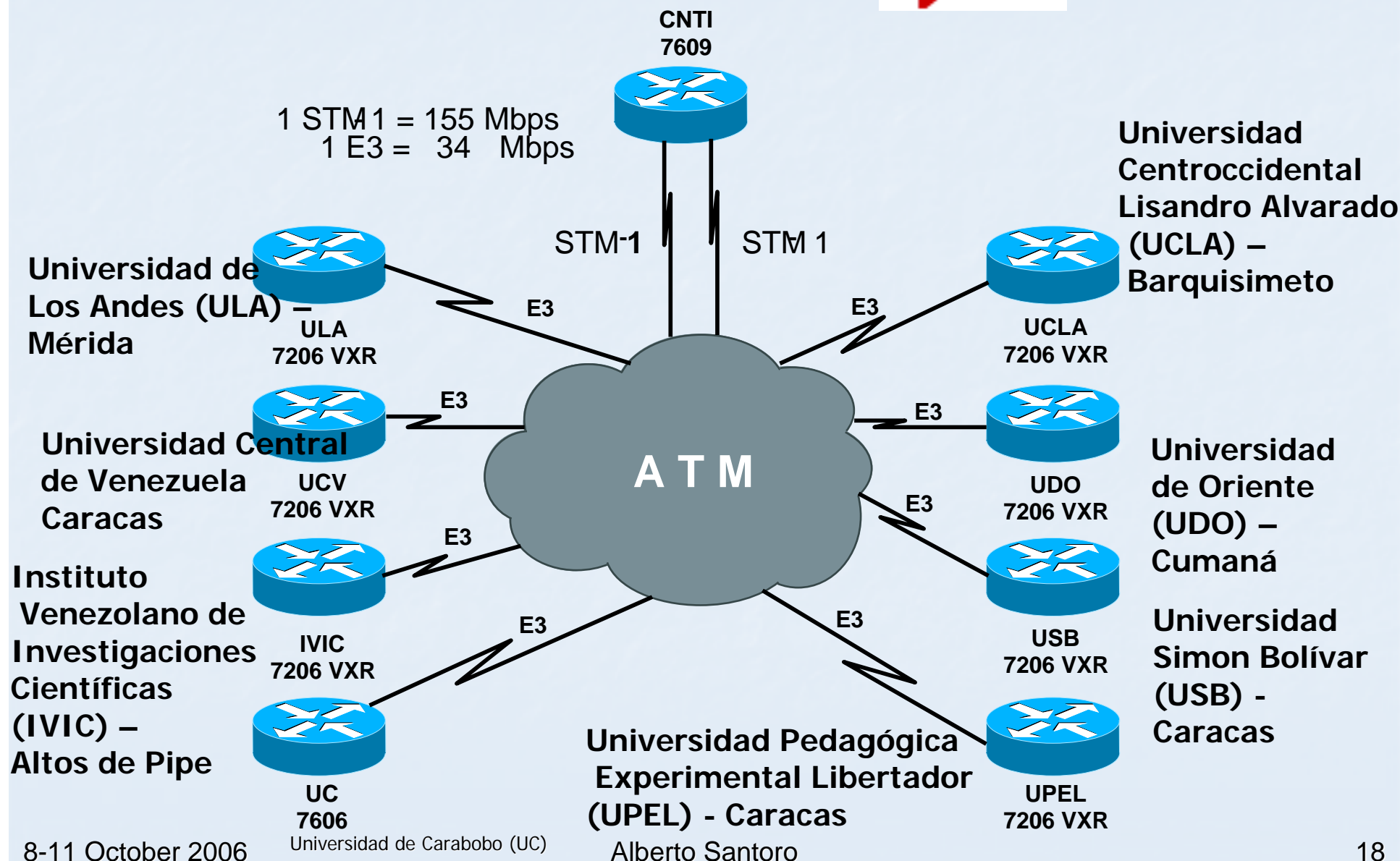
# Venezuela – REACCIUN 2

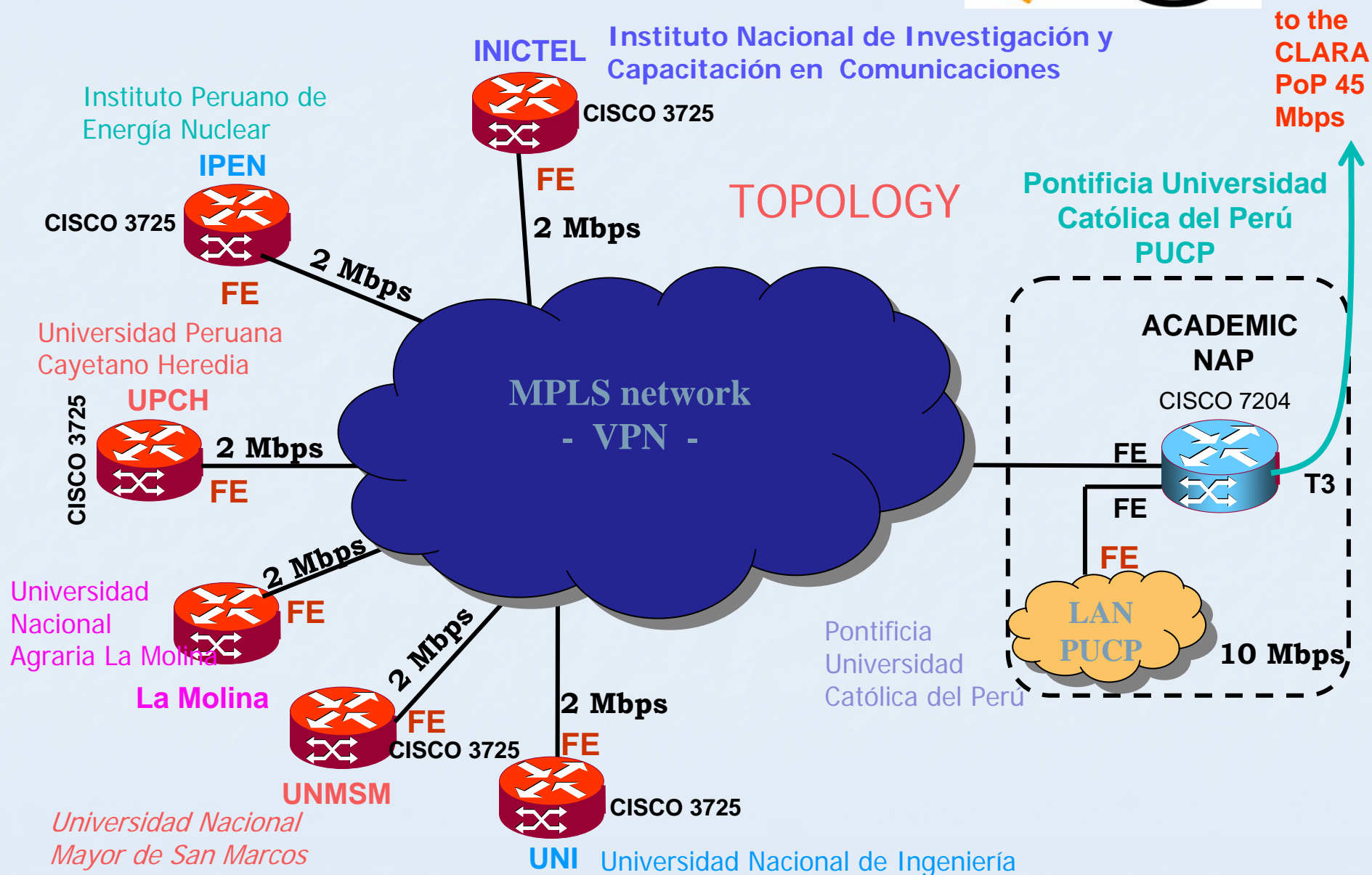
([www.reacciun2.edu.ve](http://www.reacciun2.edu.ve))



- Red Académica de Centros de Investigación y Universidades Nacionales Network maintained by Ministry of S&T, through CNTI (Centro Nacional de Tecnologías de Información)
- Phase I interconnects 8 universities to CNTI
  - Universidad de Carabobo (UC)
  - Universidad Central de Venezuela (UCV) - Caracas
  - Universidad Simón Bolívar (USB) - Caracas
  - Universidad Pedagógica Experimental Libertador (UPEL) - Caracas
  - Universidad Centroccidental Lisandro Alvarado (UCLA) – Barquisimeto
  - Universidad de Los Andes (ULA) – Mérida
  - Instituto Venezolano de Investigaciones Científicas (IVIC) - Altos de Pipe
  - Universidad de Oriente (UDO) – Cumaná
- International links via RedCLARA and AMPATH (both at 45 Mbps)

# REACCIUN 2: topology





# Colombia Red Nacional Académica de Tecnología Avanzada

NREN currently interconnects 6 regional networks with links at 10 Mbps <http://www.renata.edu.co>



## REDES REGIONALES



International connectivity to RedCLARA with 10 Mbps link to PoP in Panamá



# RENATA – present situation

## NETWORKS:

- **Bogotá – RUMBO**  
12 institutions  
[www.rumbo.edu.co](http://www.rumbo.edu.co)
- **Barranquilla – RUMBA**  
6 institutions  
[www.redrumba.edu.co](http://www.redrumba.edu.co)
- **Bucaramanga – UNIRED**  
9 institutions  
[www.unired.edu.co](http://www.unired.edu.co)
- **Cali – RUAV**  
8 institutions  
[www.ruav.edu.co](http://www.ruav.edu.co)
- **Medellín – RUANA**  
8 institutions
- **Popayán – RUP**  
7 institutions  
[www.rup.unicacuca.edu.co](http://www.rup.unicacuca.edu.co)

6 Regional  
Networks,  
50 institutions

## Under study:

- Armenia
- Pereira
- Manizales
- Pasto
- Santa Marta
- Villavicencio
- Montería
- Tunja

## Characteristics:

- National connectivity  
(10Mbps)



Country	Organization	Existing REN?	National connections	External Capacity	Number of Connected Sites	Connection to US Internet2
Argentina	RETINA	yes	256Kbps – 34 Mbps	90 Mbps CLARA	56	yes
Bolivia	BOLnet	yes	64 – 128 Kbps	1.5 Mbps	18	No OLD DATA
Brazil	RNP	yes	2 – 30 Mbps (backbone u10 Gbps)	202 Mbps & 1.2Gbps	369	yes
Chile	REUNA	yes	155 Mbps	90 Mbps Clara	18	yes
Colombia	RENATA	yes	10 Mbps	10 Mbps Clara	6	-
Costa Rica	CRNet	yes	32 – 512 Kbps	Not known	34	no
Cuba	RedUniv	University Network	19.2 Kbps– 2Mbps	Not known	23	no
Ecuador	FUNDACYT	In planning				No
El Salvador	CONACYT	In planning				no
Guatemala	Not known	Non-existent				no
Honduras	HONDUnet	Not known				no
Mexico	CUDI	Yes	155 Mbps	1 Gbps-Clara		yes
Nicaragua		Not known				no
Panama	PANNET/ SENACYT	University/ Network	2 Mbps	45 Mbps -Clara	11	no
Peru	CONCYTEC	In planning	2Mbps	45 Mbps-CLara		no
Uruguay	RAU	yes	64 Kbps to 1 Mbps	6 Mbps	46	no
Venezuela	REACCIUN	yes	155 Mbps & 34 Mbps	45 Mbps-Clara- Ampath	78	January 2003



# Internet World Stats

Usage and Population Statistics



*The Internet  
Coaching Library*



<http://www.internetworldstats.com/>

## Internet Usage in South America

<u>SOUTH AMERICA</u>	Population ( Est. 2006 )	Internet Users, Latest Data	% Population ( Penetration )	% Users in S.A.	Use Growth ( 2000-2006 )
<a href="#">Argentina</a>	37,912,201	10,000,000	26.4 %	17.5 %	300.0 %
<a href="#">Bolivia</a>	9,281,712	480,000	5.2 %	0.8 %	300.0 %
<a href="#">Brazil</a>	184,284,898	25,900,000	14.1 %	45.3 %	418.0 %
<a href="#">Chile</a>	15,666,967	6,700,000	42.8 %	11.7 %	281.2 %
<a href="#">Colombia</a>	46,620,056	4,739,000	10.2 %	8.3 %	439.7 %
<a href="#">Ecuador</a>	12,090,804	616,000	5.1 %	1.1 %	242.2 %
<a href="#">Falkland Islands</a>	2,699	1,900	70.4 %	0.0 %	n/a %
<a href="#">French Guiana (FR)</a>	199,567	38,000	19.0 %	0.1 %	1,800.0 %
<a href="#">Guyana</a>	881,932	160,000	18.1 %	0.3 %	5,233.3 %
<a href="#">Paraguay</a>	5,630,385	200,000	3.6 %	0.3 %	900.0 %
<a href="#">Peru</a>	28,476,344	4,570,000	16.0 %	8.0 %	82.8 %
<a href="#">Suriname</a>	501,582	30,000	6.0 %	0.1 %	156.4 %
<a href="#">Uruguay</a>	3,261,570	680,000	20.8 %	1.2 %	83.8 %
<a href="#">Venezuela</a>	25,307,565	3,040,000	12.0 %	5.3 %	220.0 %
<b>TOTAL</b>	370,118,282	57,154,900	15.4 %	100.0 %	299.9 %

NOTES: (1) South America Internet Usage and Population Statistics were updated for sept. 18, 2006. (2) CLICK on each country name to see detailed data for individual countries and regions. (3) Population numbers are based on data contained in [gazetteer.de](http://gazetteer.de). (4) The most recent usage comes mainly from data published by [Nielsen/NetRatings](#) , [ITU](#) , and other trustworthy sources. (5) Data on this site may be cited, giving due credit and establishing an active link back to [Internet World Stats](#) . (6) For definitions and help, see the [site surfing guide](#).  
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<http://www.internetworldstats.com/>

## WORLD INTERNET USAGE AND POPULATION STATISTICS

World Regions	Population (2006 Est.)	Population % of World	Internet Usage, Latest Data	% Population (Penetration)	Usage % of World	Usage Growth 2000-2006
<a href="#">Africa</a>	915,210,928	14.1 %	32,765,700	3.6 %	3.0 %	625.8 %
<a href="#">Asia</a>	3,667,774,066	56.4 %	394,872,213	10.8 %	36.4 %	245.5 %
<a href="#">Europe</a>	807,289,020	12.4 %	308,712,903	38.2 %	28.4 %	193.7 %
<a href="#">Middle East</a>	190,084,161	2.9 %	19,028,400	10.0 %	1.8 %	479.3 %
<a href="#">North America</a>	331,473,276	5.1 %	229,138,706	69.1 %	21.1 %	112.0 %
<a href="#">Latin America/Caribbean</a>	553,908,632	8.5 %	83,368,209	15.1 %	7.7 %	361.4 %
<a href="#">Oceania / Australia</a>	33,956,977	0.5 %	18,364,772	54.1 %	1.7 %	141.0 %
<b>WORLD TOTAL</b>	6,499,697,060	100.0 %	1,086,250,903	16.7 %	100.0 %	200.9 %

NOTES: (1) Internet Usage and World Population Statistics were updated for Sept. 18, 2006. (2) CLICK on each world region for detailed regional information. (3) Demographic (Population) numbers are based on data contained in the [world-gazetteer](#) website. (4) Internet usage information comes from data published by Nielsen//NetRatings, by the [International Telecommunications Union](#), by local NICs, and other other reliable sources. (5) For definitions, disclaimer, and navigation help, see the [Site Surfing Guide](#). (6) Information from this site may be cited, giving due credit and establishing an active link back to [www.internetworldstats.com](http://www.internetworldstats.com). © Copyright 2006, Miniwatts Marketing Group. All rights reserved worldwide.



## Important Dates

1. HEP Exp: E691 → Computing **ACP1** (parallelism, little Unix) -1986  

Network: only Bitnet
2. Heterogeneous Network (VMS+NOVELL+UNIX+WINDOWS) (1986)
3. HEP Exp: E791 → **ACP2, ACPMAPS** - (1 ACP2=10 ACP1, Lattice Calculations) (1990-1994)  

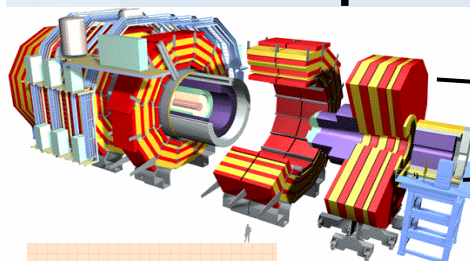
Reconstruction- >Tapes sent by airmail
4. **CHEP95 - Use Videoconference - Internacional (1995)**
5. HEP Exp: D0 → **Client/Server - FARM-IBM** - We had remote submission.

**AND NOW?**

# DISUN: Data Intensive Science University Network

And be inserted on the International GRID CMS.

## CMS Experiment



Online System

- 10s of Petabytes/yr by ~2008
- 1000 Petabytes in < 10 yrs?
- > 50% of CPU in Tier2s

0.2 - 1.5 GB/s

CERN Computer Center

10 Gb/s

10+ Gb/s

Korea

UK

Russia

FNAL

~10 Gb/s

Caltech

UCSD

UFI

UERJ

Sprace

...

DISUN

UCLA

UCR

UCSB

...

~10 Gb/s

Physics caches

PCs



Tier 0

Tier 1

Tier 2

Tier 3

Tier 4



## Some Brazilian Projects



- **CBPF (RIO)** – Got financial support to build a cluster (about 50 CPUs)  
This will be a cluster connected to our Cluster serving CMS and LHCb.

- **UFRGS (SOUTH)** – They have already a small cluster (not for HEP)  
working in software with Caltech collaboration + UERJ

- **UFRJ (RIO)** – They have collaborators for all LHC experiments and  
got recently financial support to build a Cluster

Projects: They have an approved project for upgrade the Optical  
Cabling on the Campus of the University + 20 CPUs for 2007 and 200 for 2008

LHCb group have used connectivity with SPAIN.  
Since July 2006 they are connected to EGEE  
( Enabling Grids for E-science ) via EELA.

- **UNESP (S.Paulo)** – SPRACE (T2) Upgrade recently  
NEW Project: They got a new financial support to built a GRID  
Multidisciplinary in S. Paulo – A very important e-science  
project.

- **HEPGRID UERJ (RIO)** – Project upgraded recently

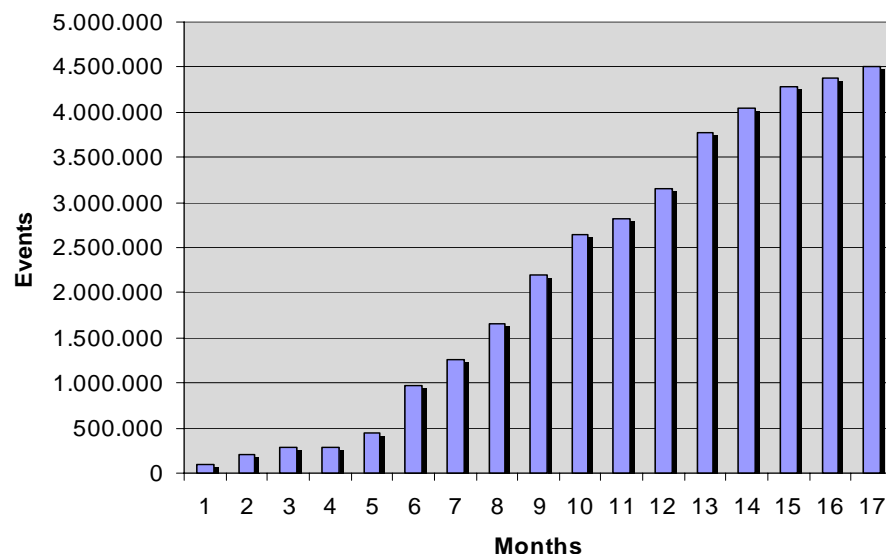


# São Paulo Regional Analysis Center

## DØ Monte Carlo Production



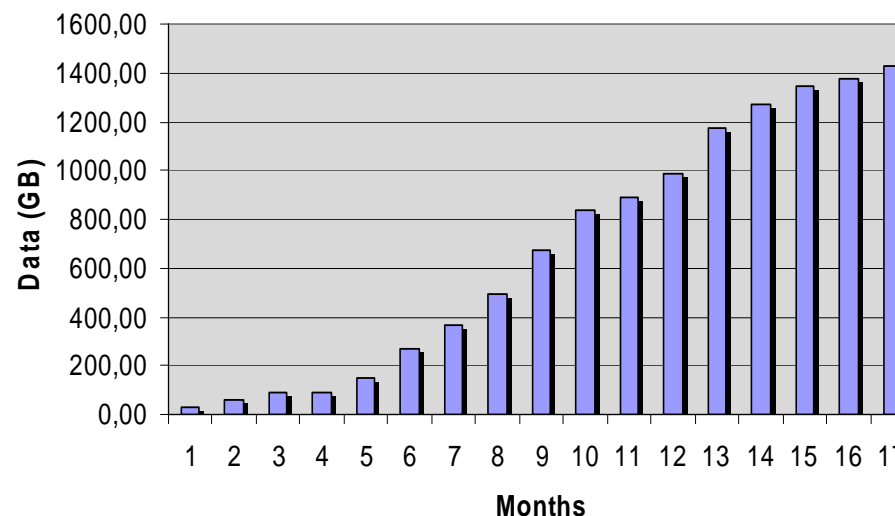
Produced MC Events



**4.51 millions  
of Monte Carlo  
Events Produced**

**1.43 TeraByte  
of Data Transferred**

Data Recorded on Tape





# New Grid Project in S. Paulo : GridUNESP

- High Energy Physics
- Lattice QCD
- High Tc Superconductivity
- Bioinformatics
- Genomics & Cancer Studies
- Protein Folding
- Molecular Biology
- Geological & Hydrographic Modeling
- Fluid Dynamics & Turbulence
- Numerical Methods in Mechanical







## T2-HEPGRID-UERJ- Physics Production



### Diffractive Production $B \rightarrow J/\psi \rightarrow \mu^+ \mu^-$

2 Million of Events in 24 hours using Double Pomeron Exchange  
Monte Carlo generator. i.e.,  $\sim 23$  ev/seg (using FAMOS from CMS)

### Diffractive Production of $t \bar{t}$

1 Million of events in 48 hours (FAMOS)

(Using only 25% of T2-Hepgrid or  $\sim 5.8$  ev./sec)



### Higgs Production

1 Million of events with final State like  $qq \rightarrow q q q q \mu \nu$

i) (500 GeV) Higgs Production (500K events)

ii) No Higgs Production (500K events)

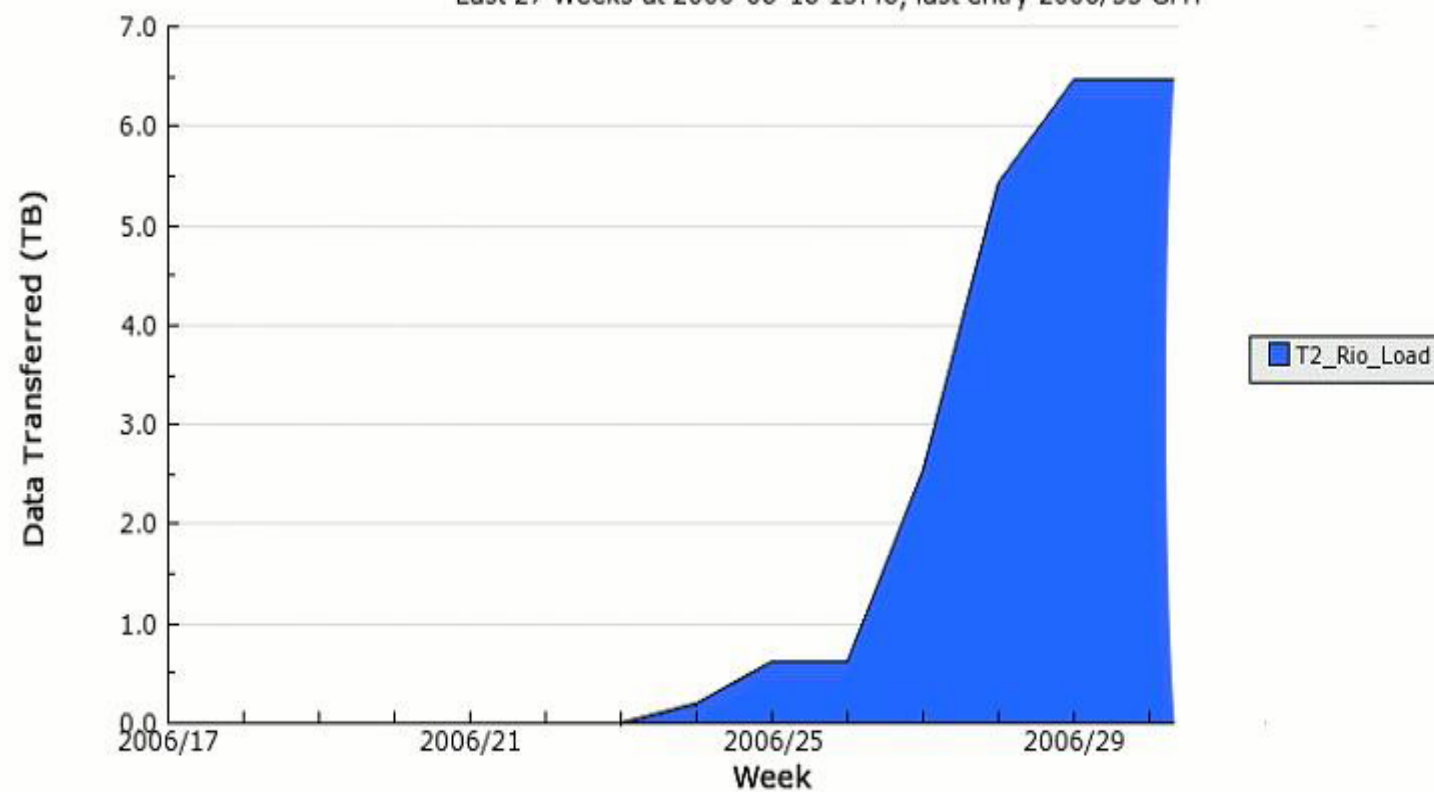
running 3 days.

Many other physics submission jobs locally and via OSG.

Participate of the sucessful test –DEMO of GGF18 Data Grid  
Interoperability Demonstration

## PhEDEx SC4 Data Transfers By Destinations matching 'Rio'

Last 27 Weeks at 2006-08-18 13:48, last entry 2006/33 GMT



# V - Conclusion

- The Computing Progress in L.A. is not homogeneous.
- Not enough to open new opportunities in science in general.
- AMPATH, CLARA, EELA are working with NRENS of the Region (LA)
- We need perhaps to push NRENS to become the center of the development to avoid the increasing Digital Divide in the region.
- Brazil represent a good example. The RNP backbone is at 10 Gbps. Working on Metropolitan Networks to extend the Backbone to whole country.

- For HEP we already started to produce physics with HEPGRID BRASIL. Lots of upgrades.
- Here also will have a significative progress in **near future.**

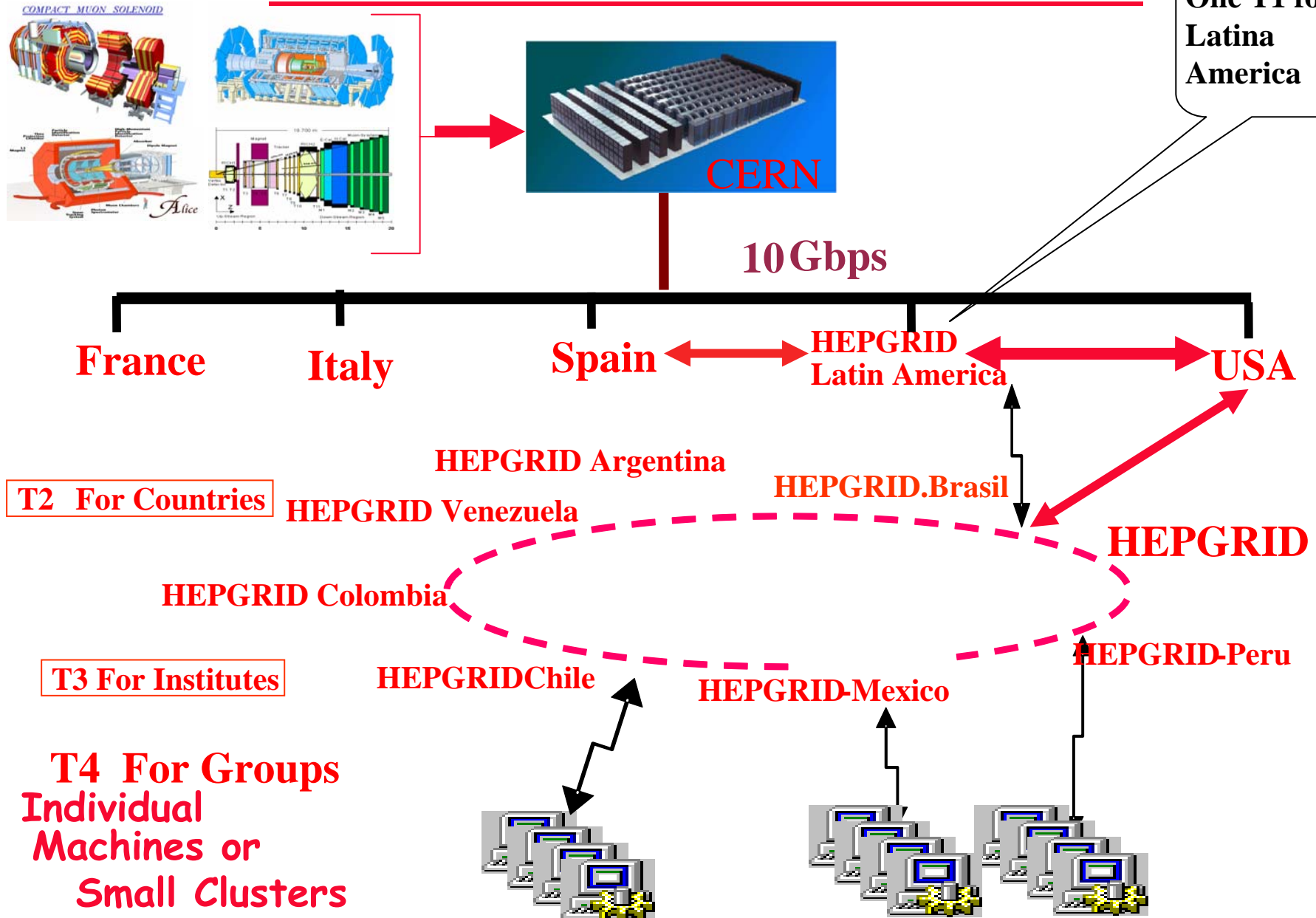
**Thank you for your Invitation !**

# EXTRA SLIDES



# An extended Model for Latin America

One T1 for  
Latina  
America



## Declaration of Lisbon, April 2006

13. We acknowledge the **progress made in the interconnection among the Latin American (redCLARA) and European (GEANT) networks, which provides a solid basis for scientific bi-regional cooperation**, contributing to achieve the objectives adopted at the World Summit on the Information Society of Tunis. In this regard, we want to bring to the attention of the Heads of State and Government the **importance of maintaining the political and financial support to initiatives that consolidate the ICT based scientific collaboration space, such as redCLARA and its interconnection with GEANT**, to guarantee its continued operation and bring an extension to the Caribbean region. We express our **support to the strengthening of EU-LAC research & development cooperation, notably in the context of Seventh EU Framework Programme for research, which will cover the period 2007-2013, based on common priorities** jointly identified and building on the potential extension of the interconnection between redCLARA and GEANT;

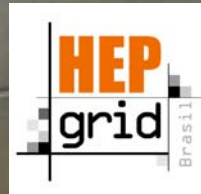
## Declaration of Vienna, May 2006

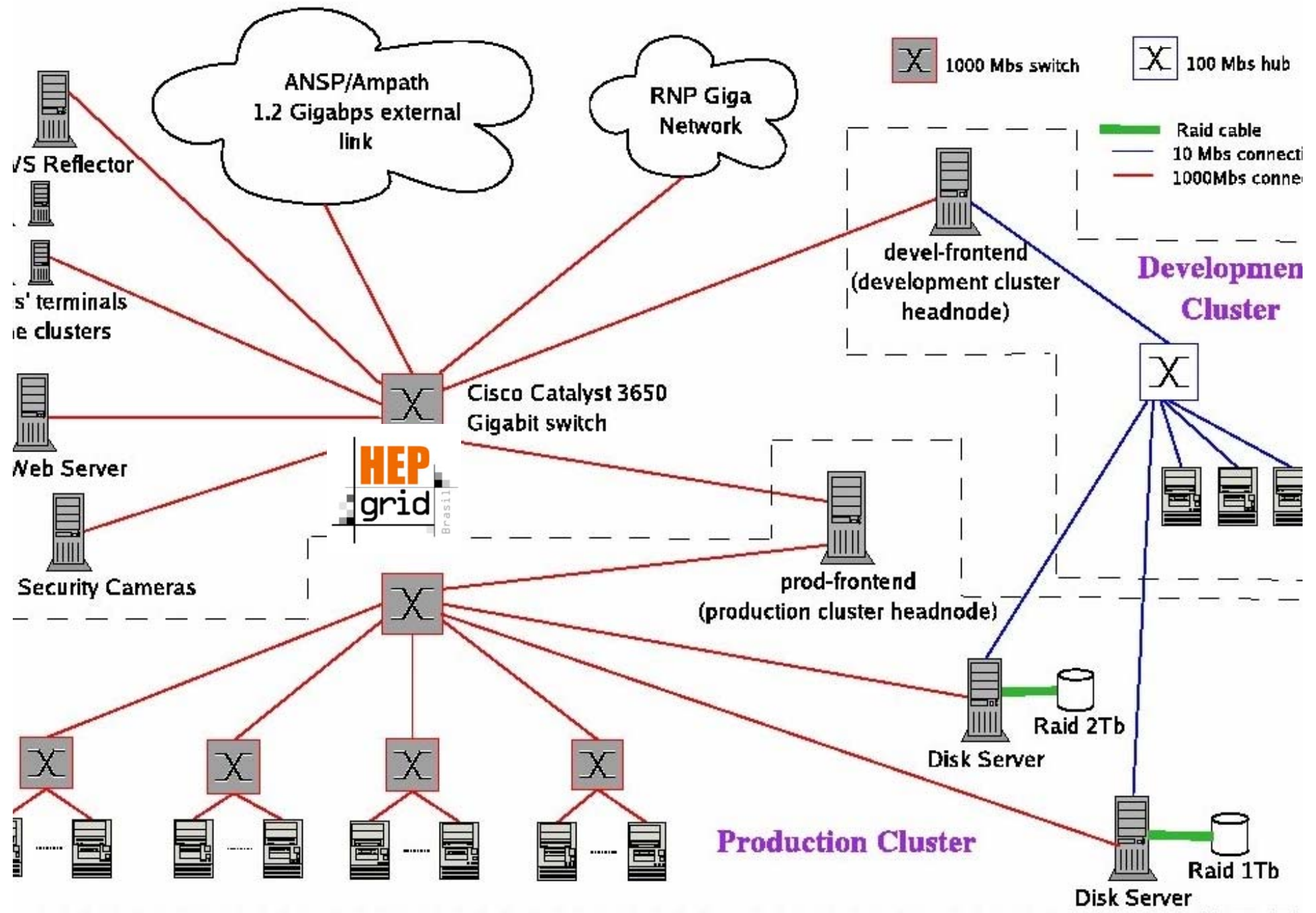
51. We recognise the role of Information and Communication Technologies to support social cohesion, regional integration and the competitiveness of our economies. We attach great importance to working together towards their further development in our regions, and towards the promotion of universal, equitable and affordable access to ICTs, notably through comprehensive strategies addressing the new challenges and opportunities of technological convergence.

**We welcome the outcome and the declaration adopted at the IV EU-LAC Ministerial Information Society Forum "An alliance for social cohesion through digital inclusion" held in Lisbon in April 2006. We acknowledge the encouraging achievements of the on-going bi-regional activities in this field and consider that it is important to maintain the political and financial support to initiatives that consolidate the ICT-based scientific collaboration space.**



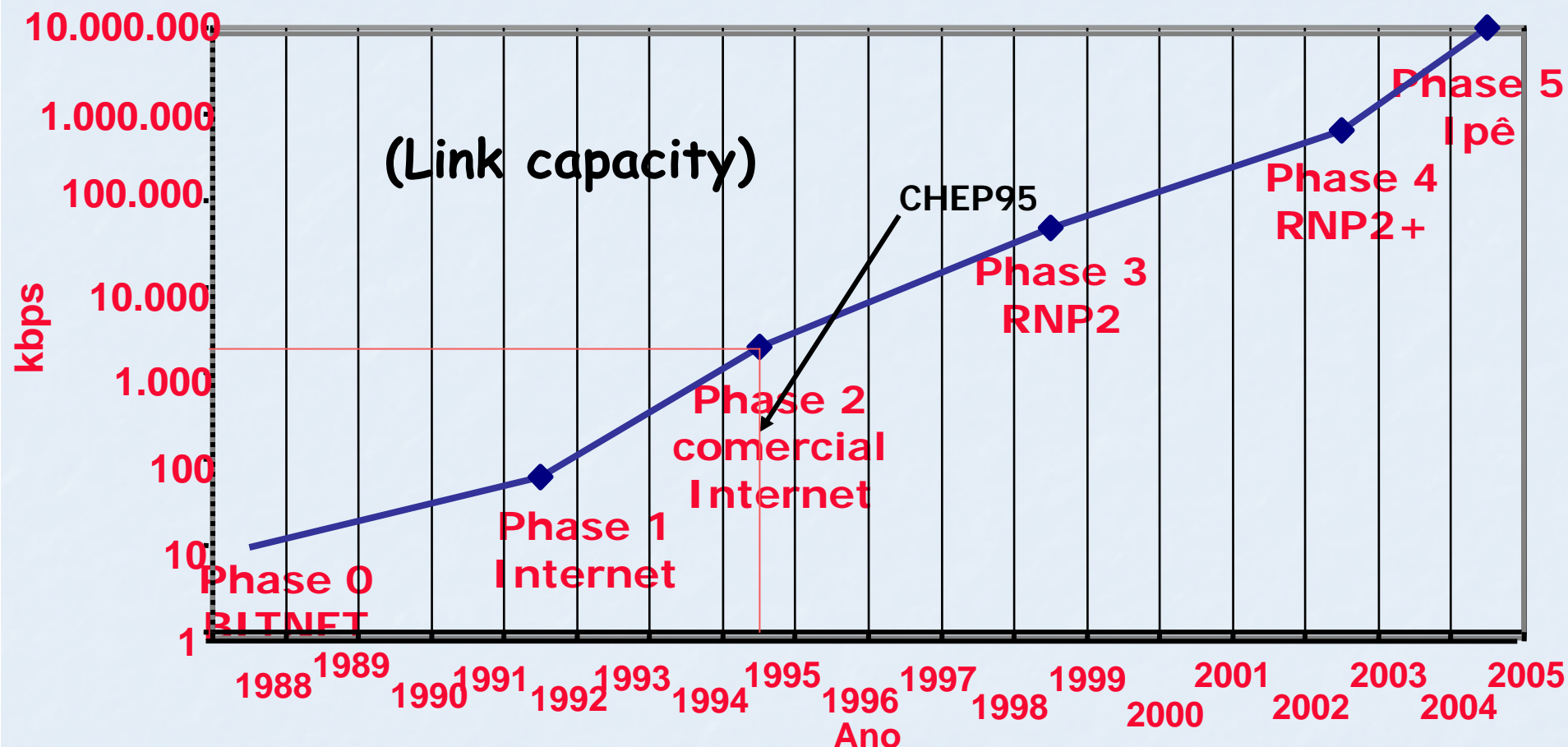
## T2 – HEPGRID BRAZIL







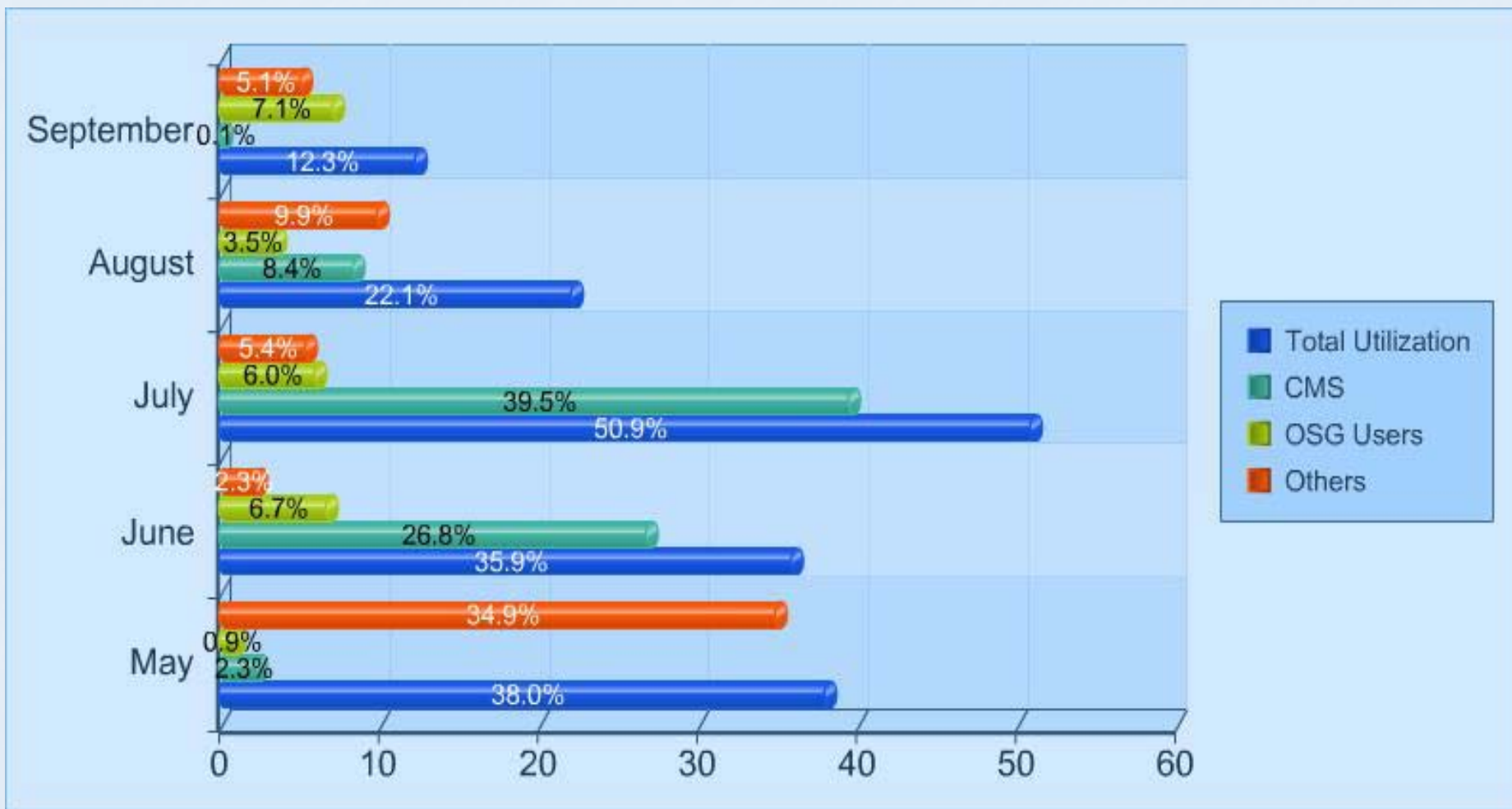
GRID = The power/storage + Network



Let me follow the information I received from Dr. Michael Stanton –Inovation Director from RNP, about RNP-Projects

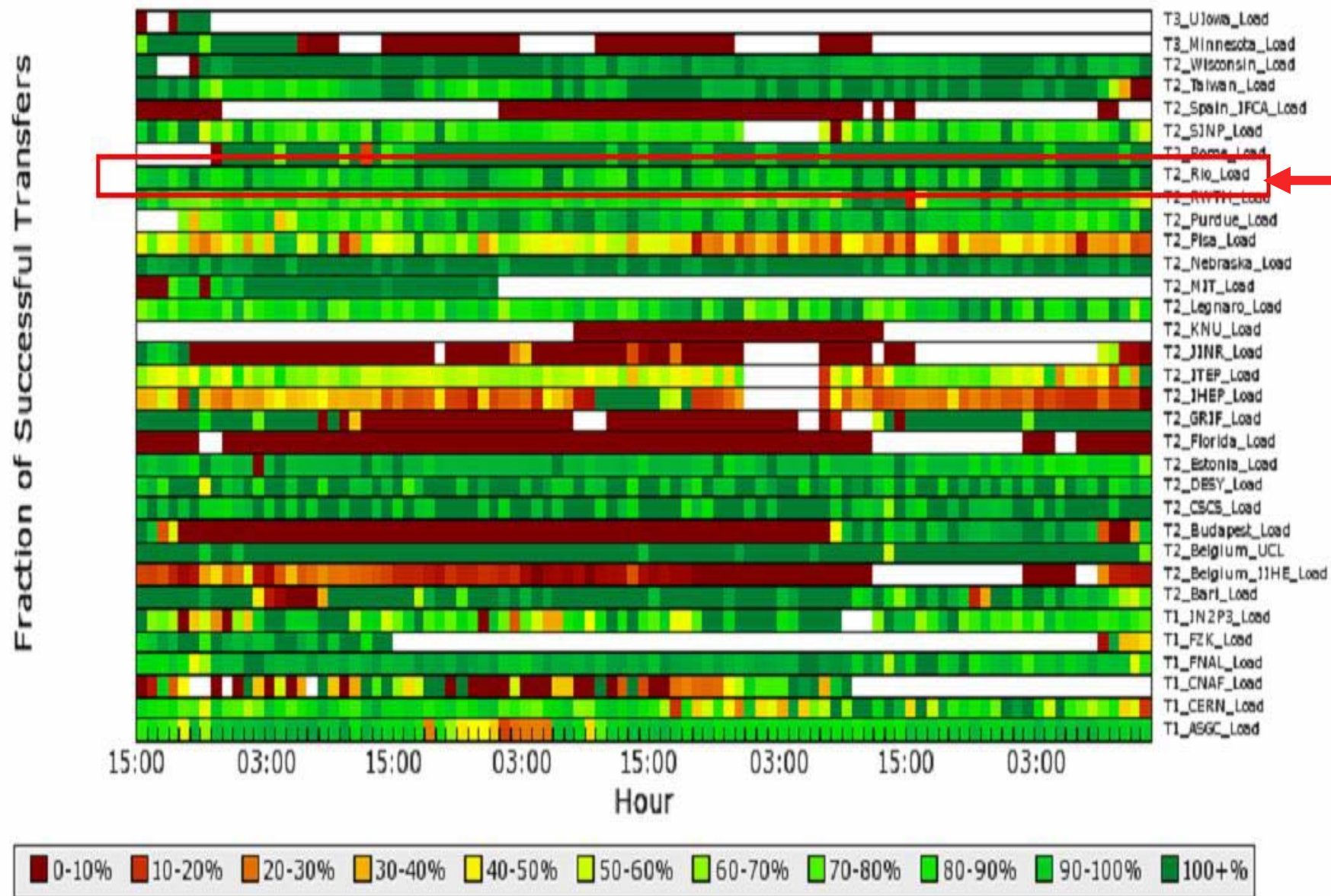
## Jobs' Statistics on T2-HEPGRID UERJ -2006



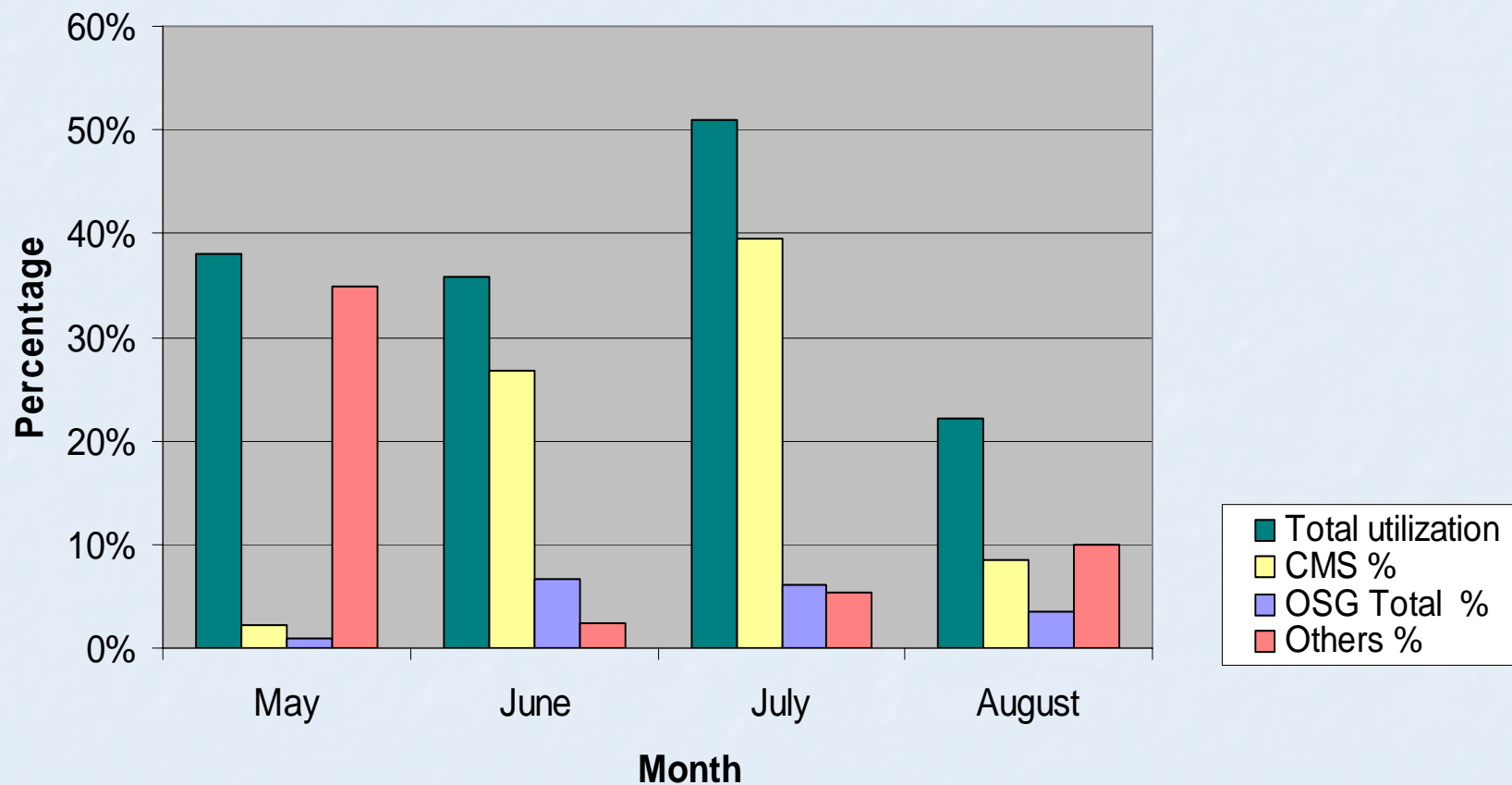


# PhEDEx SC4 Transfer Quality By Destination

Last 96 Hours at 2006-07-18 13:31, last entry 2006-07-18 13:00 GMT

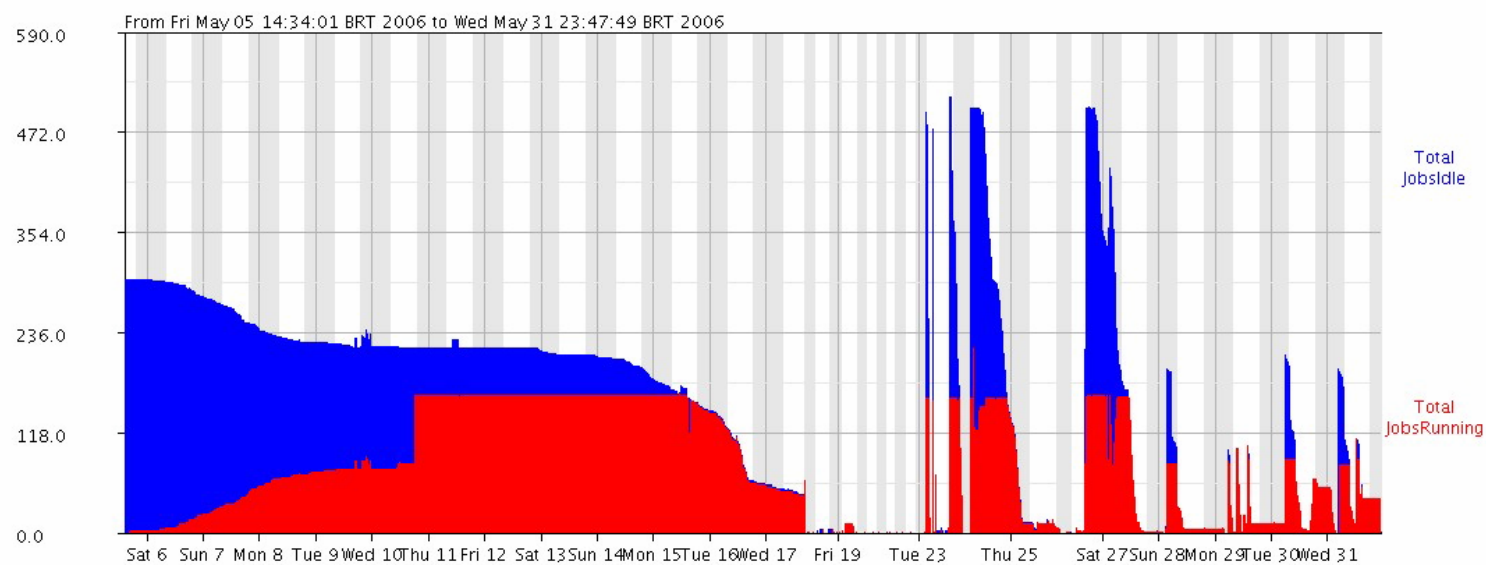


## *T2-Hepgrid cluster utilization*

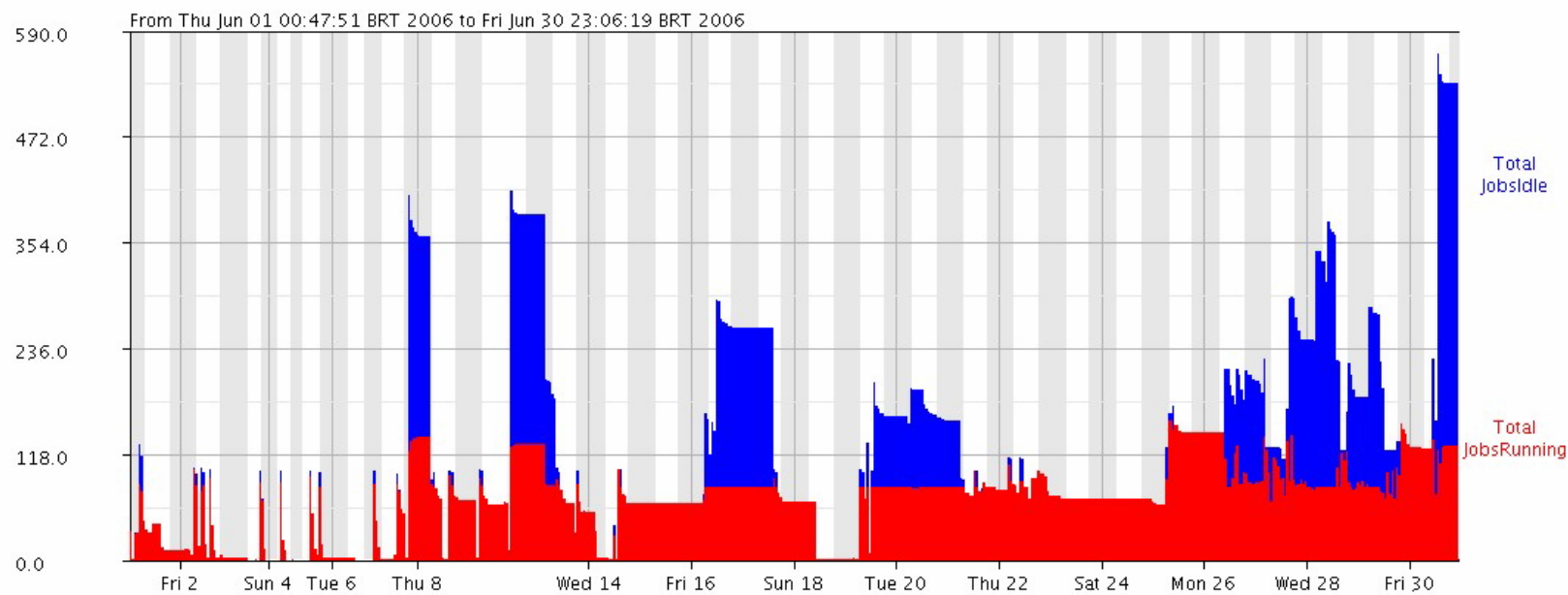




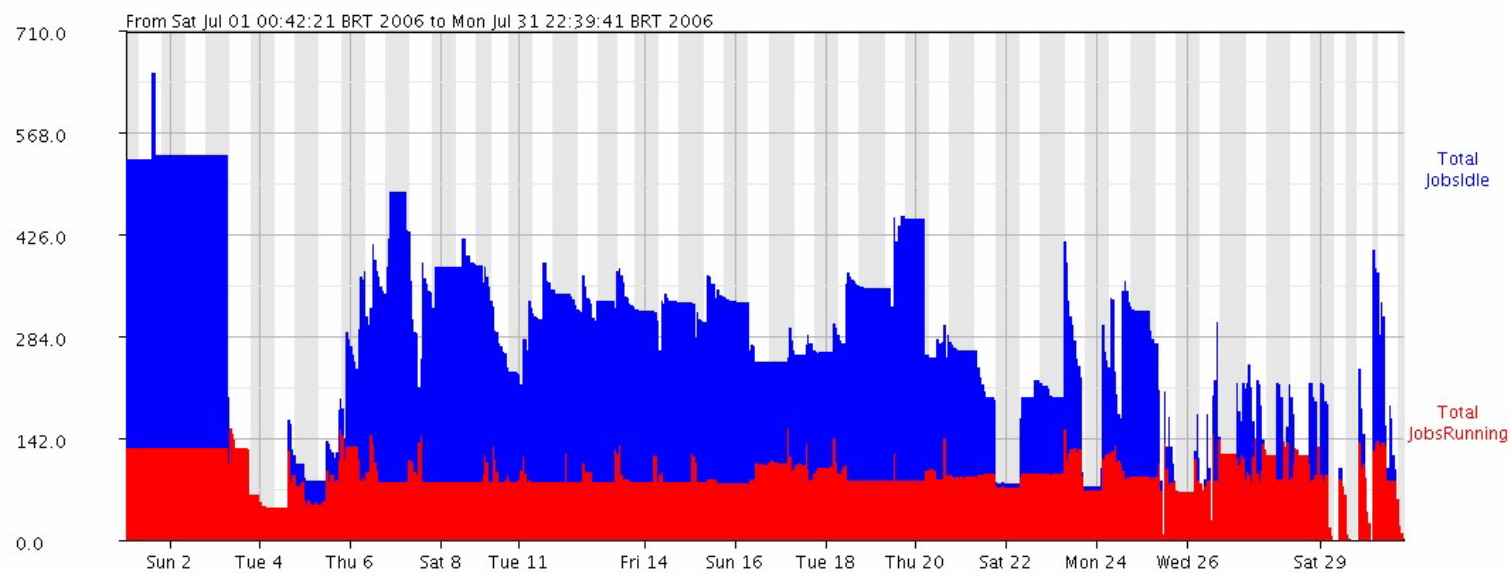
## HEPGRID UERJ Condor Pool User Statistics for May



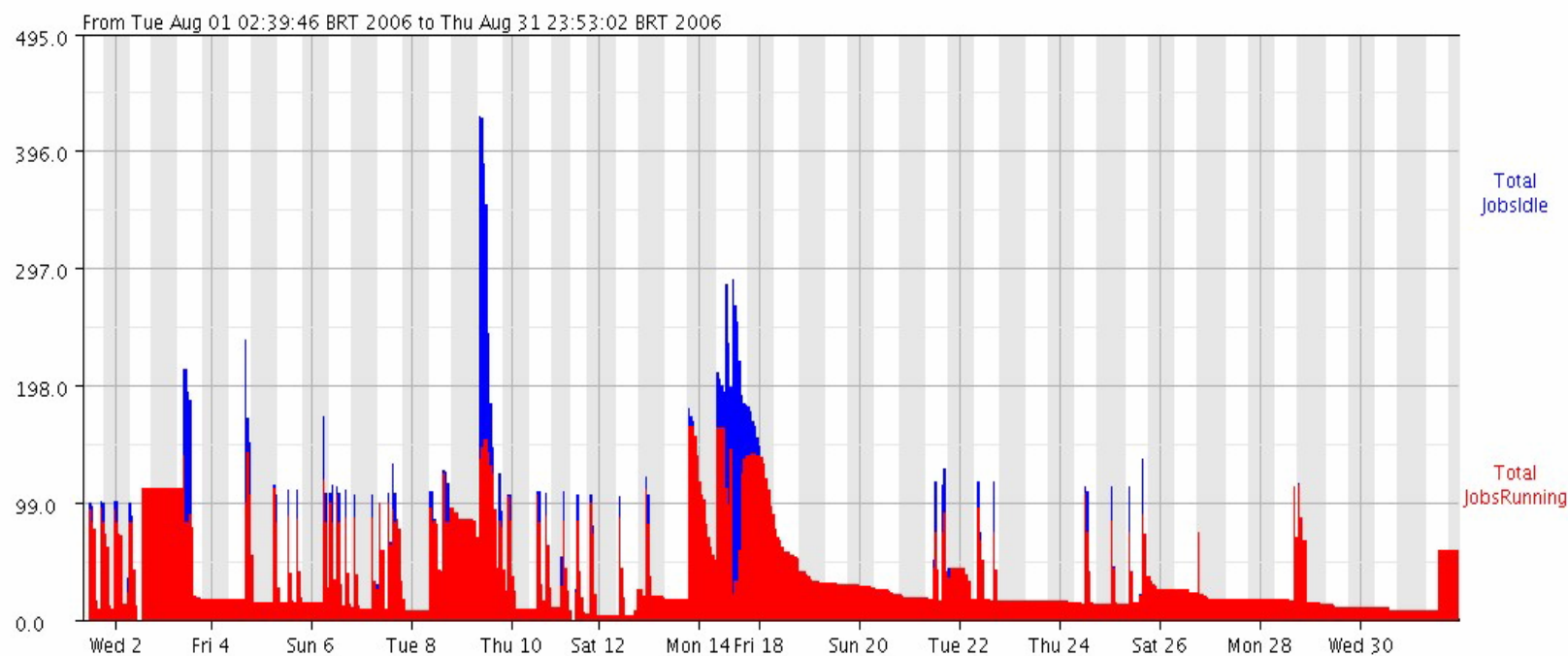
## HEPGRID UERJ Condor Pool User Statistics for Jun



## HEPGRID UERJ Condor Pool User Statistics for Jul



## HEPGRID UERJ Condor Pool User Statistics for Aug



# GGF18 Data Grid

## Interoperability Demonstration

- Goal: demonstrate **uniform access**, replication of data collections and associated metadata between multiple **federated data grids**
  - Technology advances **information-driven collaborative infrastructures**,
    - supporting **e-Science** and other large distributed interactions
  - Coordinator – San Diego Supercomputer Center (SDSC)
    - Reagan Moore ([moore@sdsc.edu](mailto:moore@sdsc.edu))
  - Federation of data grids based on the SDSC Storage Resource Broker (SRB) middleware
  - 19 participant institutions, 12 countries involved
  - Replication demo focused on Brazilian data infrastructures
    - UERJ T2 HEPGrid and RNP/USP
  - Presented at Global Grid Forum 18<sup>th</sup> – 11-14 September, 2006



# GGF18 Data Grid

## Interoperability Demonstration

- Brazilian Connectivity provided by:
  - Rede GIGA – Advanced Optical Experimental Network in Brazil
  - RNP – Brazilian National Education and Research Network
  - CLARA – Latin American Cooperation of Advanced Networks
  - WHREN-LILA – Western Hemisphere Research & Education Networks – Links Interconnecting Latin America
- Data Collections used in the federated data grid
  - T2 HEPGrid Brasil
    - High energy physics collection
  - NOAO – National Optical Astronomy Observatory
    - Astronomy image collection
  - NARA –
    - Historical records collection

# Participants

## 19 Data Grids

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■ ChinaGrid – China:	Li Qi	<a href="mailto:quick.qi@gmail.com">quick.qi@gmail.com</a>
■ DEISA-Italy:	Giuseppe Fimeni	<a href="mailto:g.fiameni@cineca.it">g.fiameni@cineca.it</a>
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■ WUNGrid – UK:	Sheau-Yen Chen	<a href="mailto:sheauc@sdsc.edu">sheauc@sdsc.edu</a>

IPÊ Tree

