

# Center for Scientific Computing GridUNESP & SPRACE

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Scientific Director

Núcleo de Computação Científica

Universidade Estadual Paulista



# GridUNESP Project

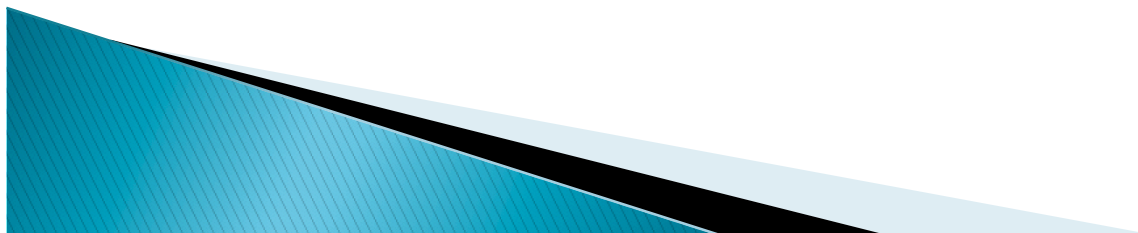
- ▶ A Campus Grid for a Multi-Campuses University

- ▶ Timeline :

- 2004: Call for Scientific Projects
- 2005: Funding requested to FINEP
- 2006: Proposal approved by FINEP
- 2007: Project starts
- 2008: Hardware acquisition
- 2009: Datacenter construction

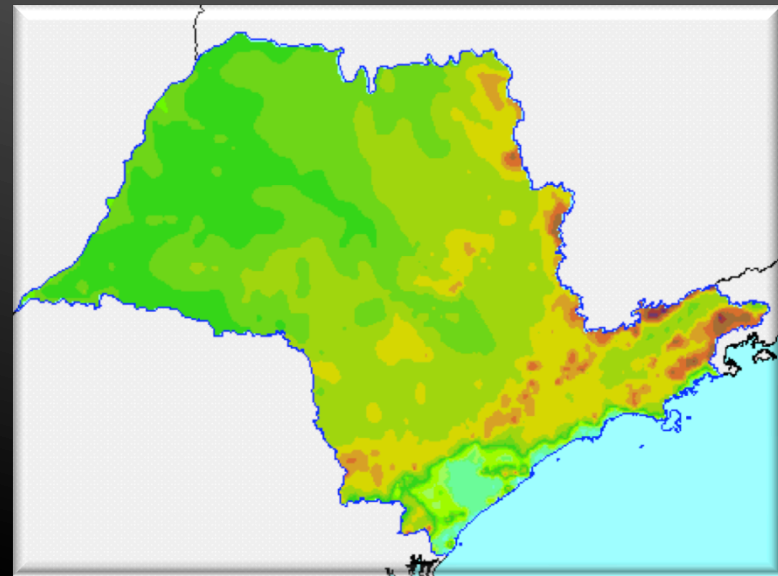


- ▶ Inauguration : September 2009



# São Paulo State

- ▶ 1 / 5 Brazilian Population
  - People from several heritages:
    - Italian, Portuguese, Spanish, Lebanese, Syrian, Asians, Germany
- ▶ 1 / 3 Brazilian Economy
- ▶ Investment in P&D
  - Larger than Argentina, Chile, and México
- ▶ Scientific Publications
  - ~50% Brazil
- ▶ Area
  - 250K km<sup>2</sup> ≈ United Kingdom
- ▶ Population
  - 40.5M ≈ Spain
- ▶ GDP/PPP
  - US\$ 500B ≈ 2 X Switzerland

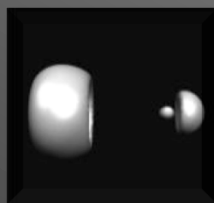


• Source: The World Fact Book (CIA)

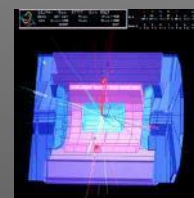
# GridUNESP Research Areas



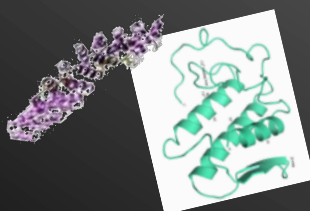
Biological  
Networks



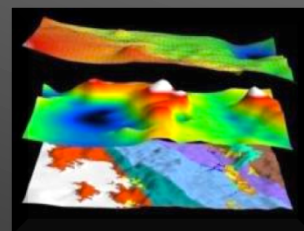
Relativistic  
Chemistry



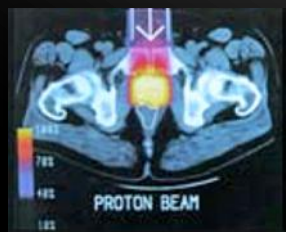
High Energy  
Physics



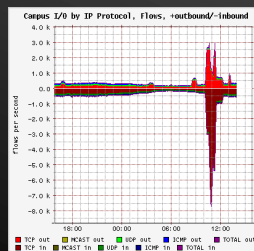
Molecular  
Dynamics



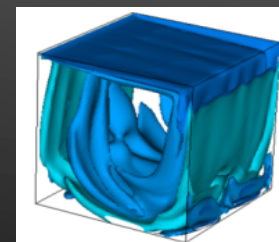
Geological  
Modeling



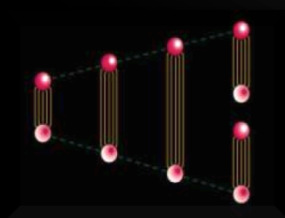
Medical  
Physics



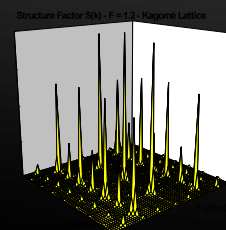
Network  
Security



Turbulence



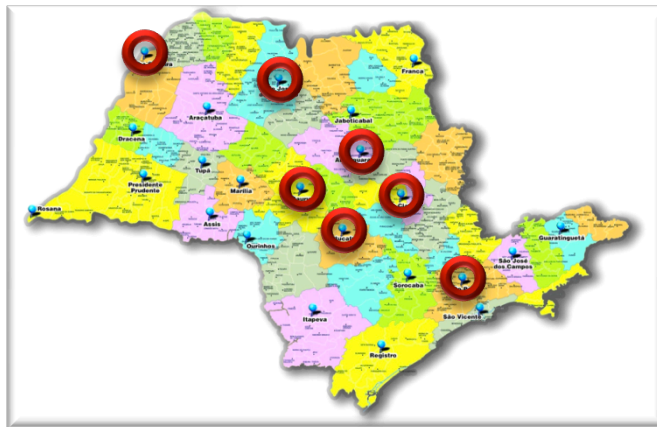
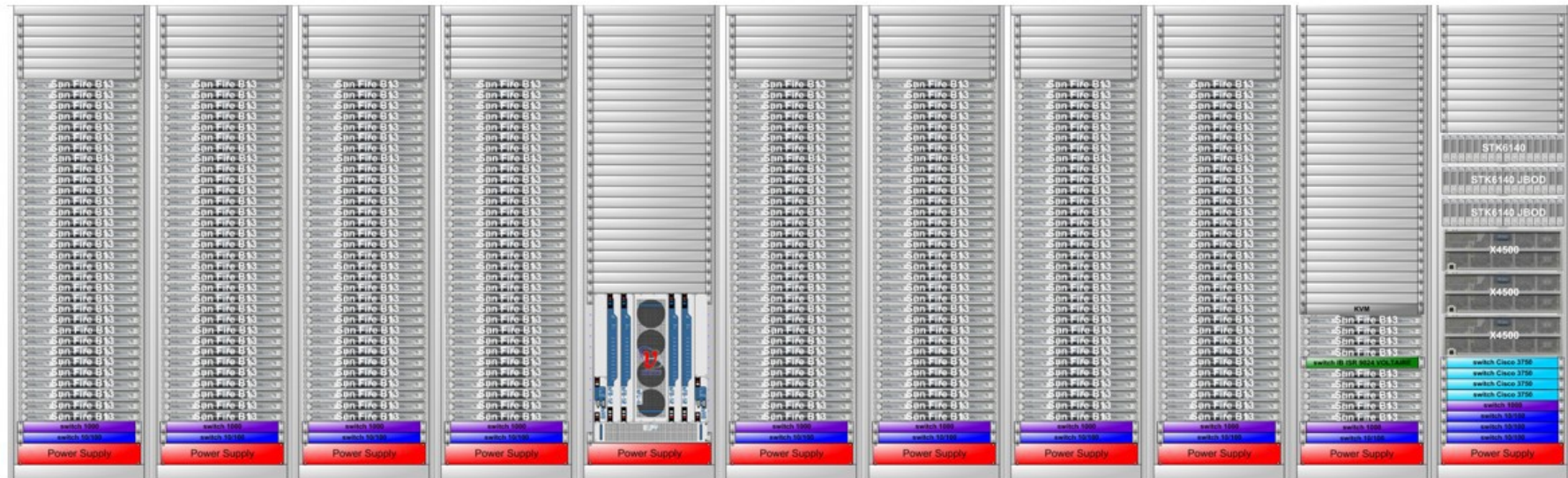
Lattice  
QCD



High Tc  
Superconductivity



# Clusters: 33.3 TeraFlops

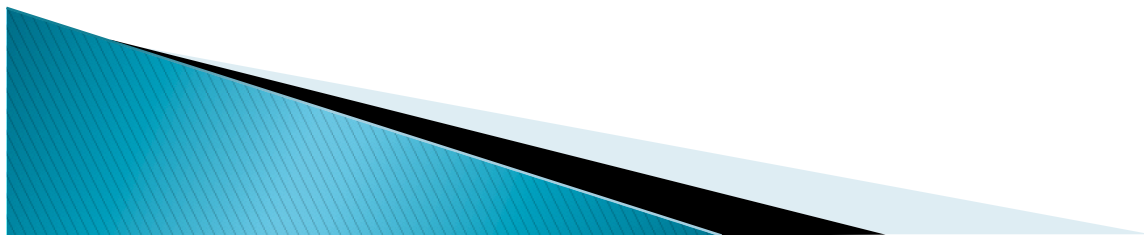


+ 7 X



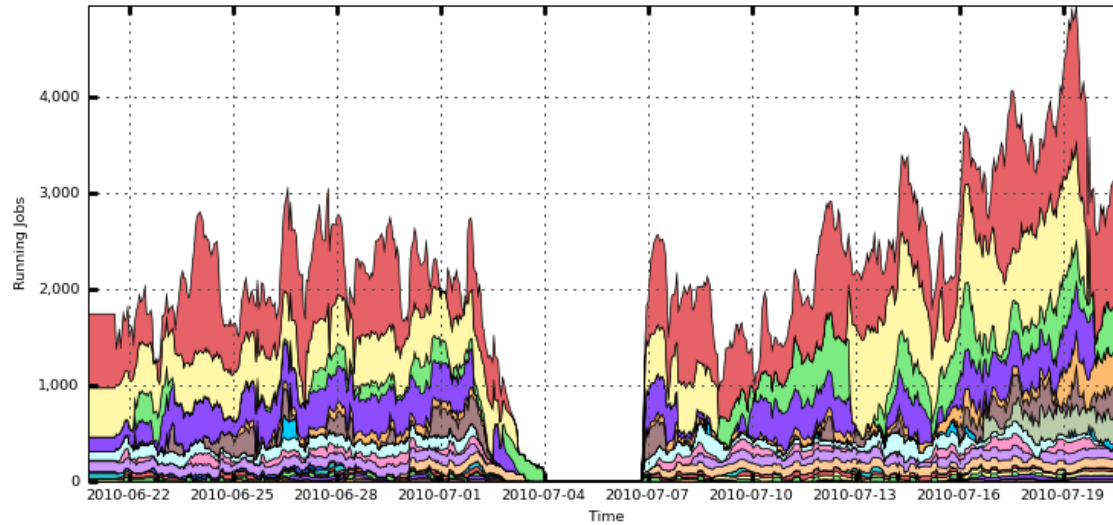
# Partnership with Open Science Grid

- ▶ Signed in 2008:
  - Share the physical infrastructure
    - GridUNESP the only OSG VO outside US
  - Leverage the use of OSG middleware and integration activities
  - Promote technical collaboration and training activities
  - Exchange technical staff and researchers
  - Collaborate in HTC R&D

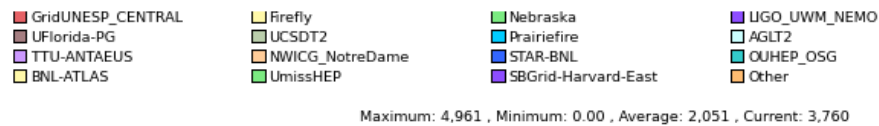


# VO do LIGO (MIT & Caltech)

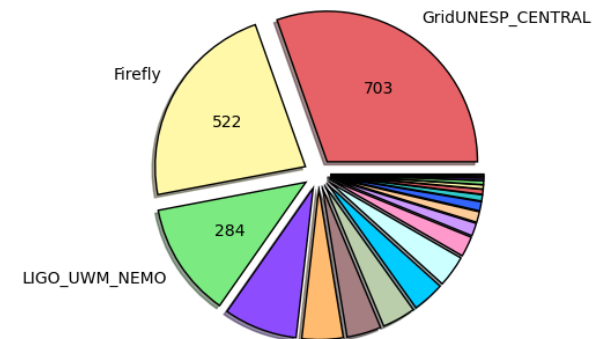
Count of Running Jobs by Facility  
4 Weeks from 2010-06-20 to 2010-07-20



GridUNESP



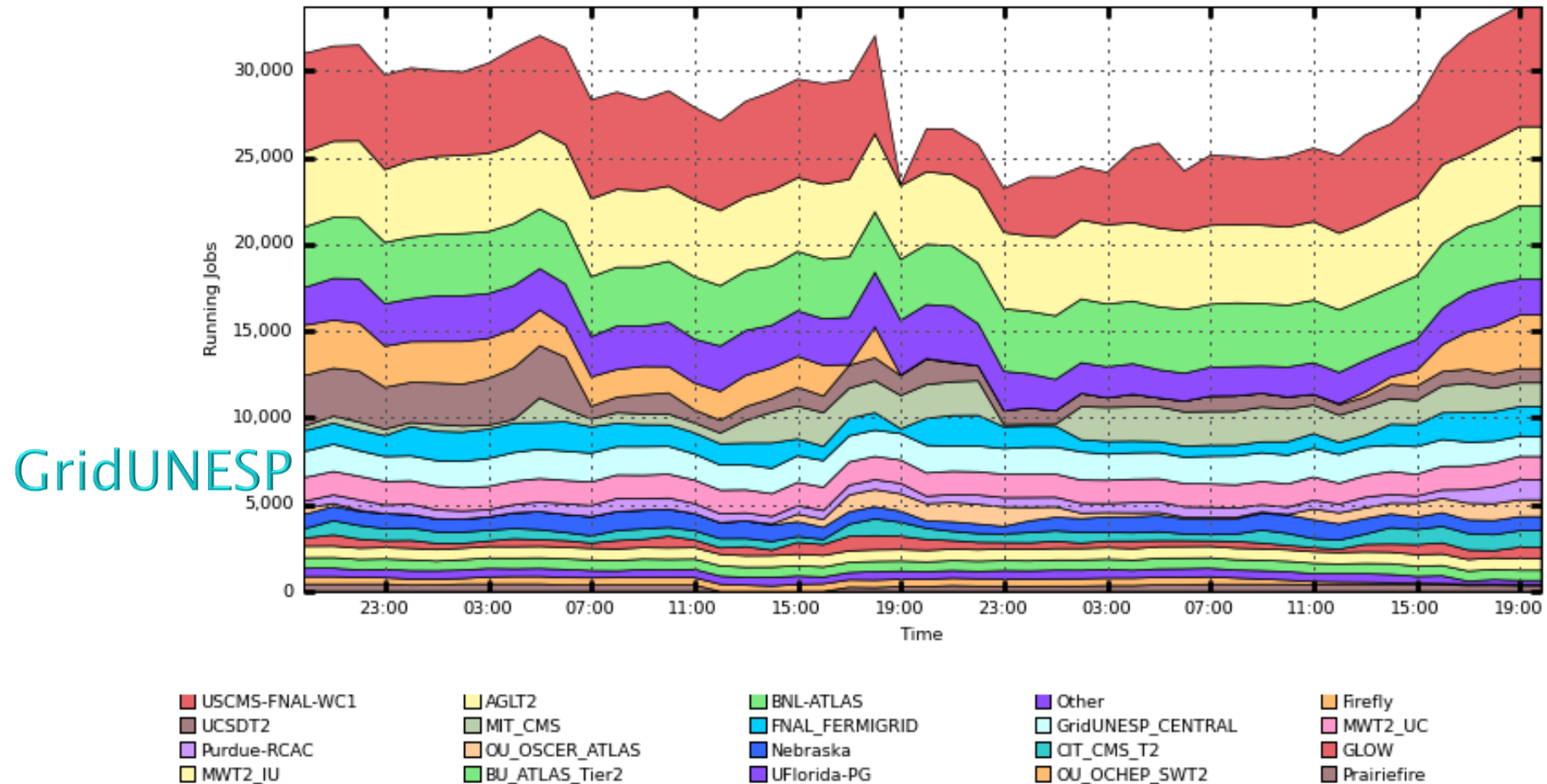
Count of Running Jobs by Facility (Sum: 2,313)  
4 Weeks from 2010-06-20 to 2010-07-20



# GridUNESP e o Hardware do OSG

## Count of Running Jobs by Facility

0 Weeks from 2010-07-18 19:50 to 2010-07-20 19:50

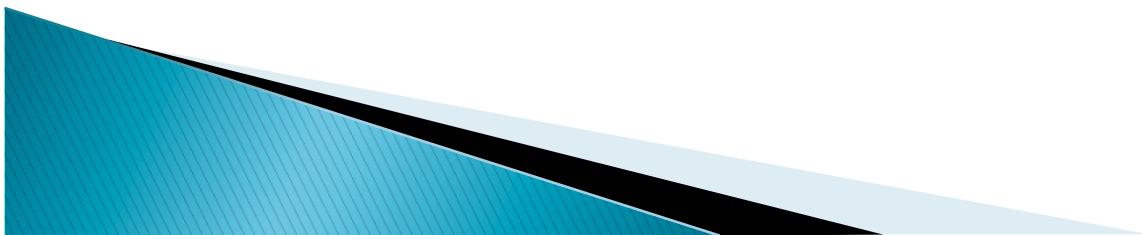


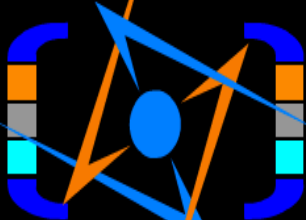
Maximum: 33,721 , Minimum: 0.00 , Average: 27,449 , Current: 33,721



# Central Monitoring

- ▶ Integrates
  - Nagios + Cacti + Ganglia
- ▶ 300+ hosts and switches monitored
  - Central and peripheral clusters
- ▶ 2500+ services monitored
  - Load, temperature, memory, disk space;
  - Room temperature and humidity;
  - Hardware Status (service LED);
  - Uptime of server and workernode.





LOCATION

STATUS

Arapaquara	UP
Bauru	DOWN
Botucatu	UP
Rio Claro	UP
São José do Rio Preto	UP
São Paulo	UP
Ilha Solteira	UP

SERVER

LOAD

norma.ncc.unesp.br	4.54/8.60/8.74
pictor.ncc.unesp.br	1.05/0.32/0.16
caelum.ncc.unesp.br	0.00/0.00/0.00
reticulum.ncc.unesp.br	0.00/0.03/0.00
fornax.ncc.unesp.br	0.00/0.00/0.00

# JOBS

USERS

1185	ligo
209	sangrid
187	hcc
66	netonic
7	iara
6	rotf
4	denikino

TIMEZONES

CHICAGO	11:17:01 am
SÃO PAULO	2:17:01 pm
GENEVA	6:17:01 pm

COMPUTE ELEMENT

STORAGE ELEMENT

HOSTS UP

302

HOSTS DOWN

0

HOSTS IN DOWNTIME

0

10 sec

## GRIDUNESP OVERVIEW

LOAD 1

0.68

LOAD 5

0.77

LOAD 15

0.98

UPTIME

UP 40 DAYS, 22:05, 1 USER,

UP 151 DAYS, 42 MIN, 0 USERS,

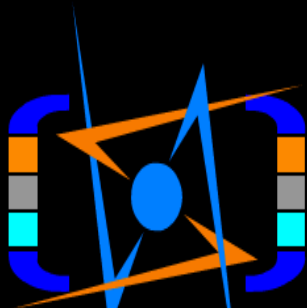
## GRID SONAR



OK

CONDITION GREEN





LOCATION

STATUS

Araraquara	UP
Bauru	DOWN
Botucatu	UP
Rio Claro	UP
São José do Rio Preto	UP
São Paulo	UP
Ilha Solteira	UP

SERVER

LOAD

norma.ncc.unesp.br	13.09/10.24/9.04
pictor.ncc.unesp.br	0.02/0.12/0.09
caelum.ncc.unesp.br	0.00/0.00/0.00
reticulum.ncc.unesp.br	0.08/0.05/0.01
formax.ncc.unesp.br	0.00/0.00/0.00

# JOBS

USERS

1184	ligo
209	samgrid
188	hcc
66	netionic
7	iara
6	rott
4	denikino

TIMEZONES

CHICAGO	11:11:15 am
SÃO PAULO	2:11:15 pm
GENEVA	6:11:15 pm

COMPUTE ELEMENT

STORAGE ELEMENT

HOSTS UP

302

HOSTS DOWN

0

HOSTS IN DOWNTIME

0

27 sec

## GRIDUNESP OVERVIEW

LOAD 1

0.68

LOAD 5

0.93

LOAD 15

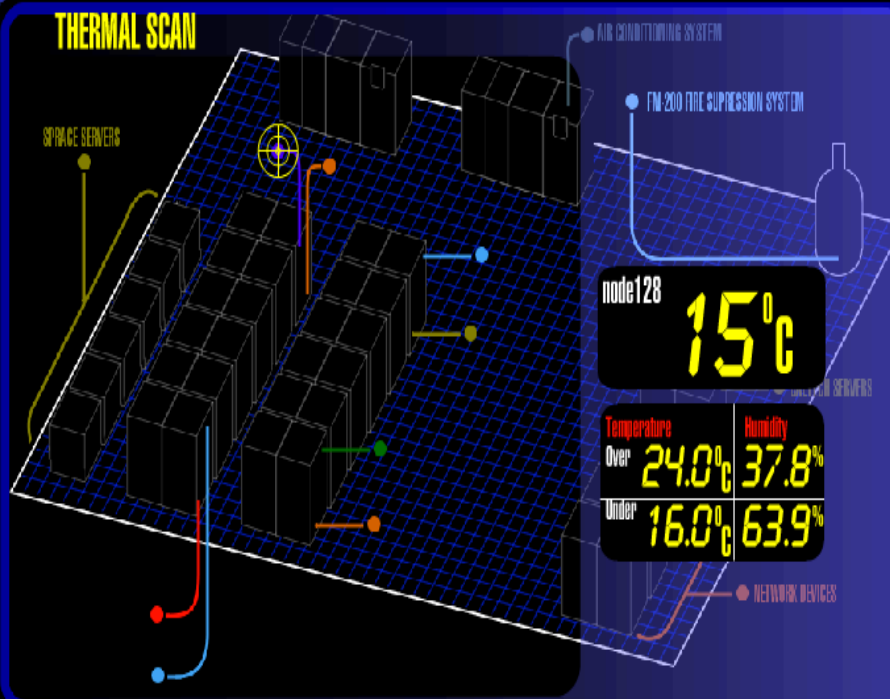
1.12

UPTIME

UP 40 DAYS, 21:59, 1 USER,

UP 151 DAYS, 36 MIN, 0 USERS,

THERMAL SCAN

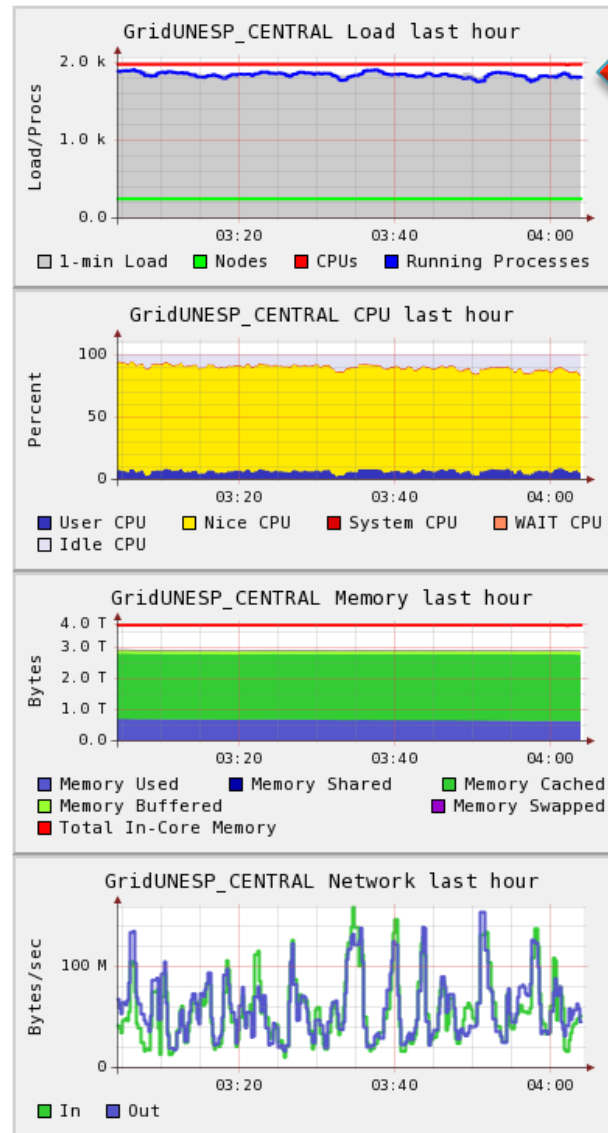
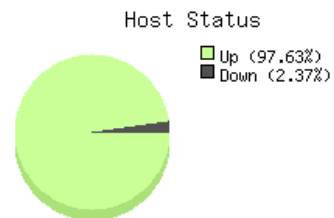
OK  
CONDITION GREEN

### Overview of GridUNESP\_CENTRAL

CPU's Total: **1976**  
Hosts up: **247**  
Hosts down: **6**

Avg Load (15, 5, 1m):  
**93%, 93%, 91%**

Localtime:  
**2010-07-14 04:04**



# Ganglia



**Current Network Status**  
 Last Updated: Tue Jul 20 16:36:16 BRT 2010  
 Updated every 90 seconds  
 Nagios® Core™ 3.2.0 - [www.nagios.org](http://www.nagios.org)  
 Logged in as winckler

[View Service Status Detail For All Service Groups](#)  
[View Status Summary For All Service Groups](#)  
[View Service Status Grid For All Service Groups](#)

Host Status Totals			
Up	Down	Unreachable	Pending
302	0	0	0
All Problems		All Types	
0		302	

Service Status Totals				
Ok	Warning	Unknown	Critical	Pending
2455	4	48	1	0
All Problems		All Types		
63		2508		

Service Overview For All Service Groups

I/Om Hardware Status Services (IomServices)				Load Services (LoadServices)				Memory Services (MemServices)			
Host	Status	Services	Actions	Host	Status	Services	Actions	Host	Status	Services	Actions
ice	UP	1.0K		access	UP	1.0K		kvmsvr	UP	UNKNOWN	
node001	UP	1.0K		dfs01	UP	1.0K		node001	UP	1.0K	
node002	UP	1.0K		dfs02	UP	1.0K		node002	UP	1.0K	
node003	UP	1.0K		dfs03	UP	1.0K		node003	UP	1.0K	
node004	UP	1.0K		dfs04	UP	1.0K		node004	UP	1.0K	
node005	UP	1.0K		kvmsvr	UP	UNKNOWN		node005	UP	1.0K	
node006	UP	1.0K		node001	UP	1.0K		node006	UP	1.0K	
node007	UP	1.0K		node002	UP	1.0K		node007	UP	1.0K	
node008	UP	1.0K		node003	UP	1.0K		node008	UP	1.0K	
node009	UP	1.0K		node004	UP	1.0K		node009	UP	1.0K	
node010	UP	1.0K		node005	UP	1.0K		node010	UP	1.0K	
node011	UP	1.0K		node006	UP	1.0K		node011	UP	1.0K	
node012	UP	1.0K		node007	UP	1.0K		node012	UP	1.0K	
node013	UP	1.0K		node008	UP	1.0K		node013	UP	1.0K	
node014	UP	1.0K		node009	UP	1.0K		node014	UP	1.0K	
node015	UP	1.0K		node010	UP	1.0K		node015	UP	1.0K	
node016	UP	1.0K		node011	UP	1.0K		node016	UP	1.0K	
node017	UP	1.0K		node012	UP	1.0K		node017	UP	1.0K	
node018	UP	1.0K		node013	UP	1.0K		node018	UP	1.0K	
node019	UP	1.0K		node014	UP	1.0K		node019	UP	1.0K	
node020	UP	1.0K		node015	UP	1.0K		node020	UP	1.0K	

Nagios









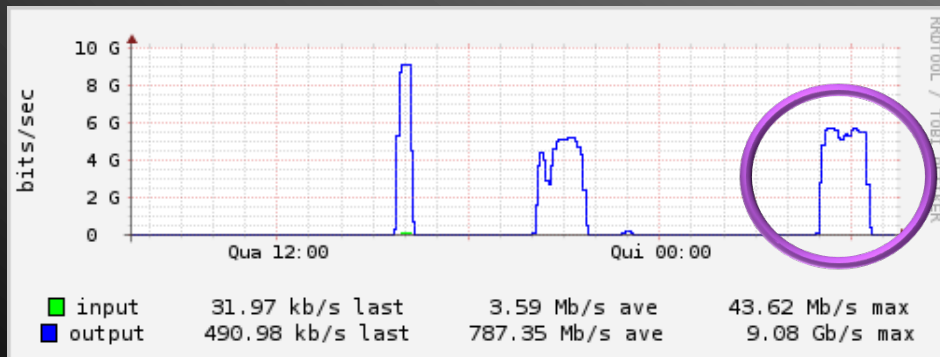
US\$ 800K



[www.kyatera.fapesp.br](http://www.kyatera.fapesp.br)

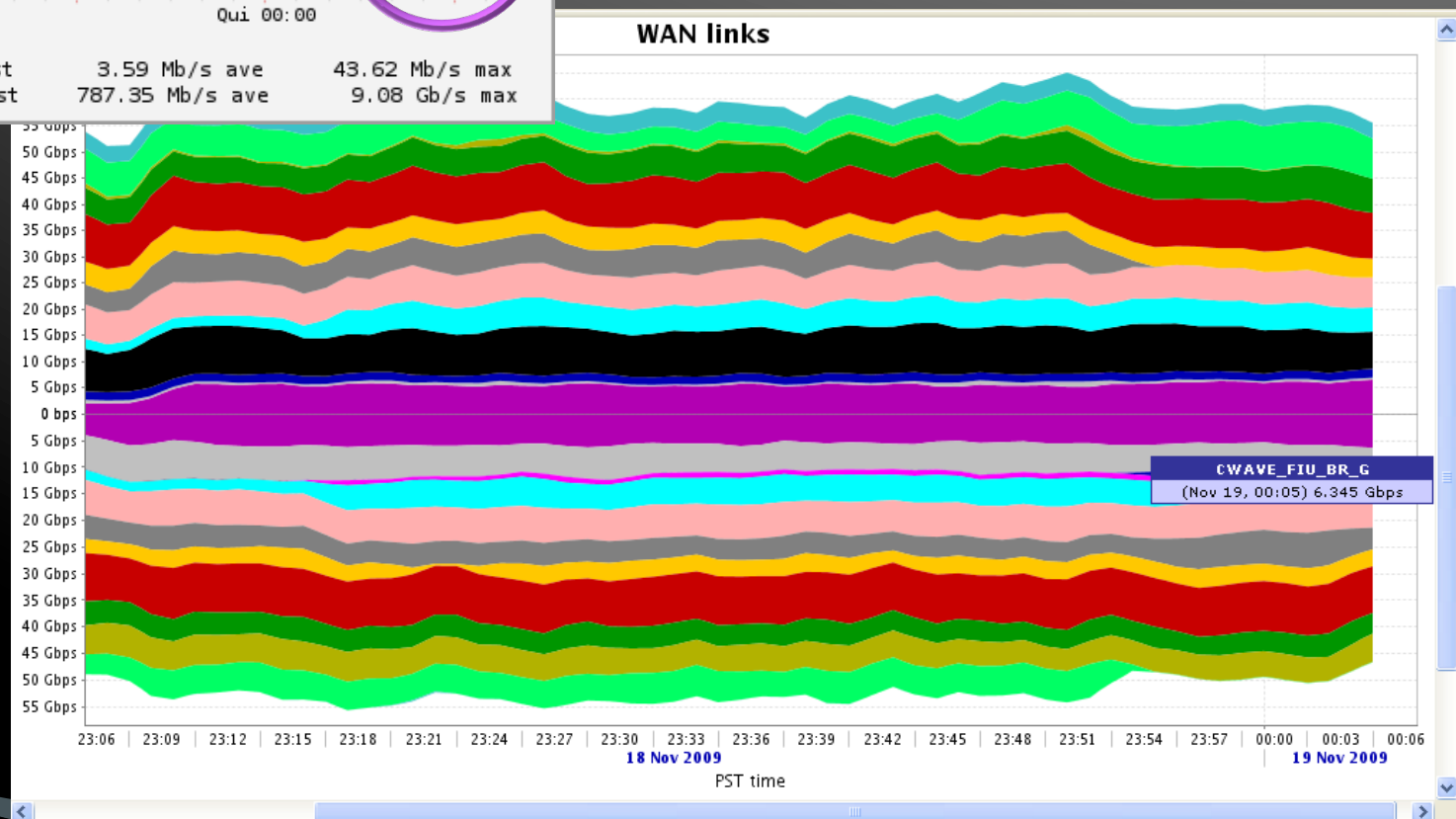


# SC09: Official Run (disk-to-disk)



Stable Transfer  
São Paulo-Portland de ~6 Gbps  
Sustained for 1h30

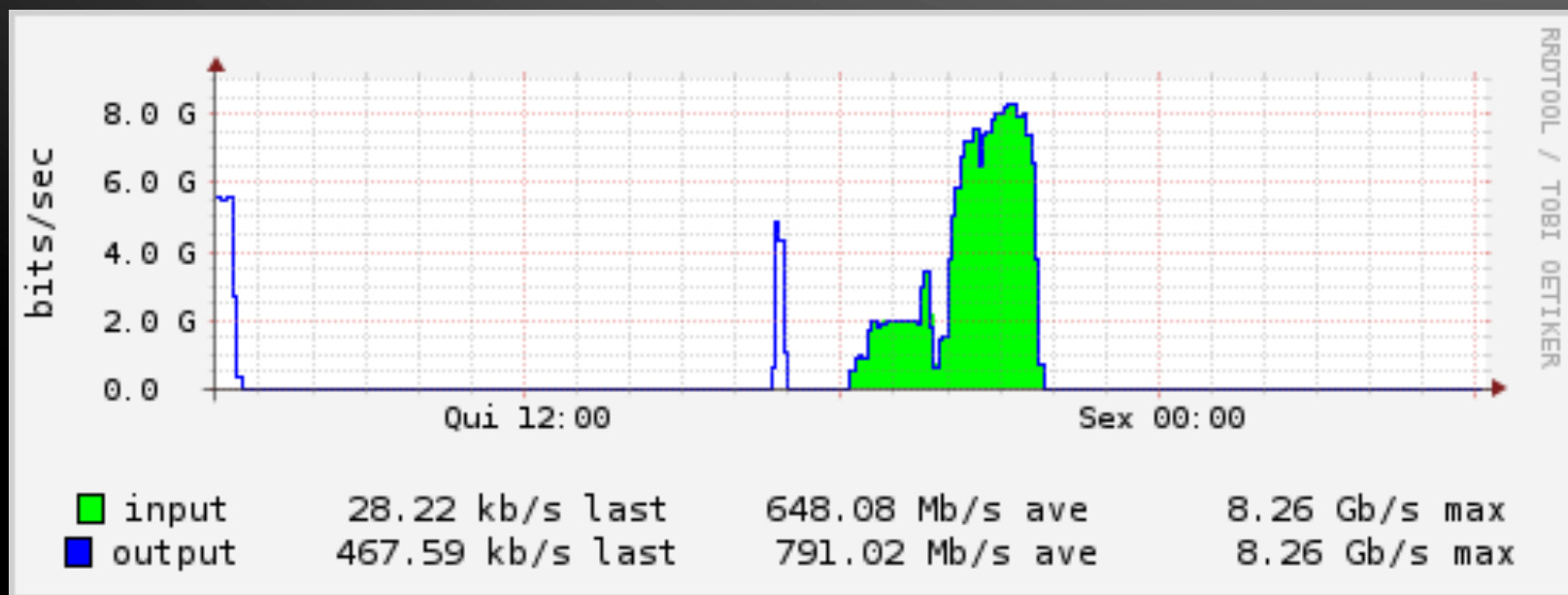
GridUNESP



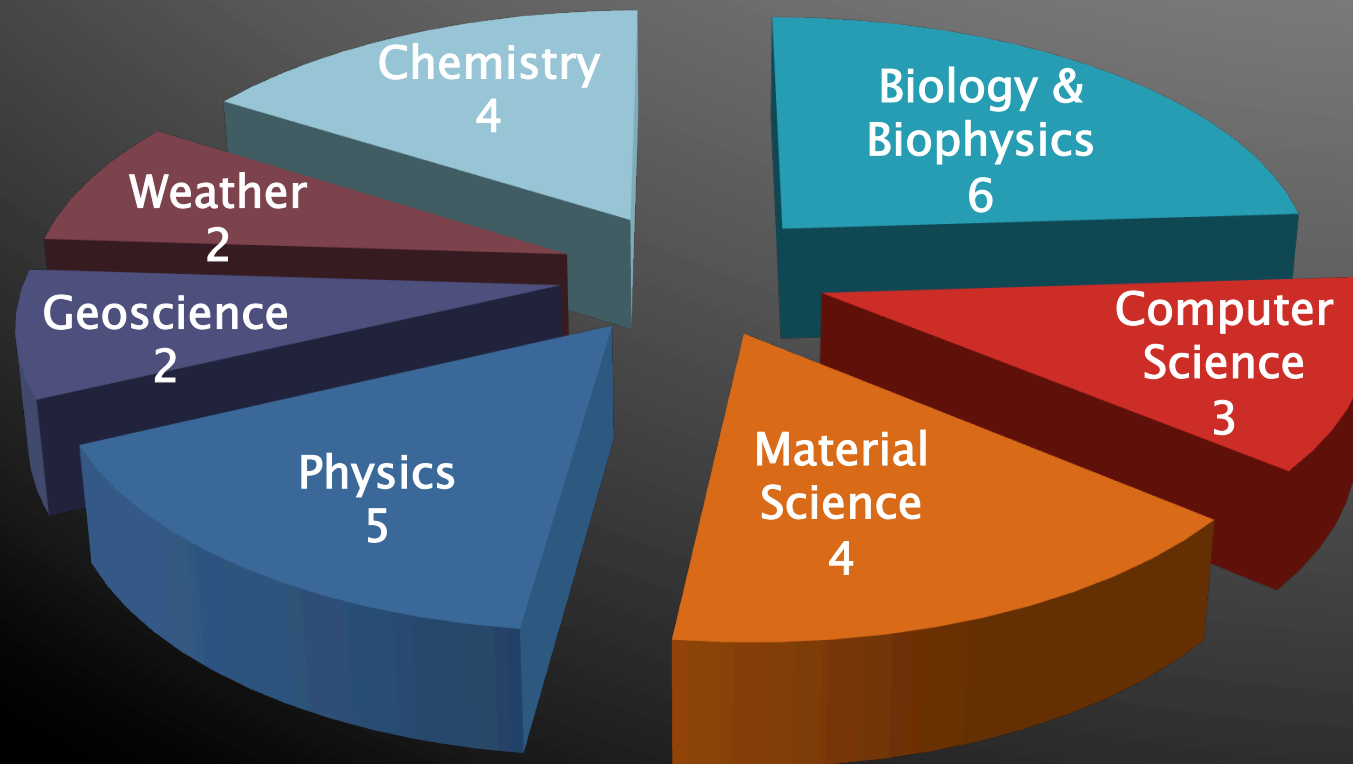


# Recorde de Transmissão Hemisfério Norte-Sul (19/Nov/09)

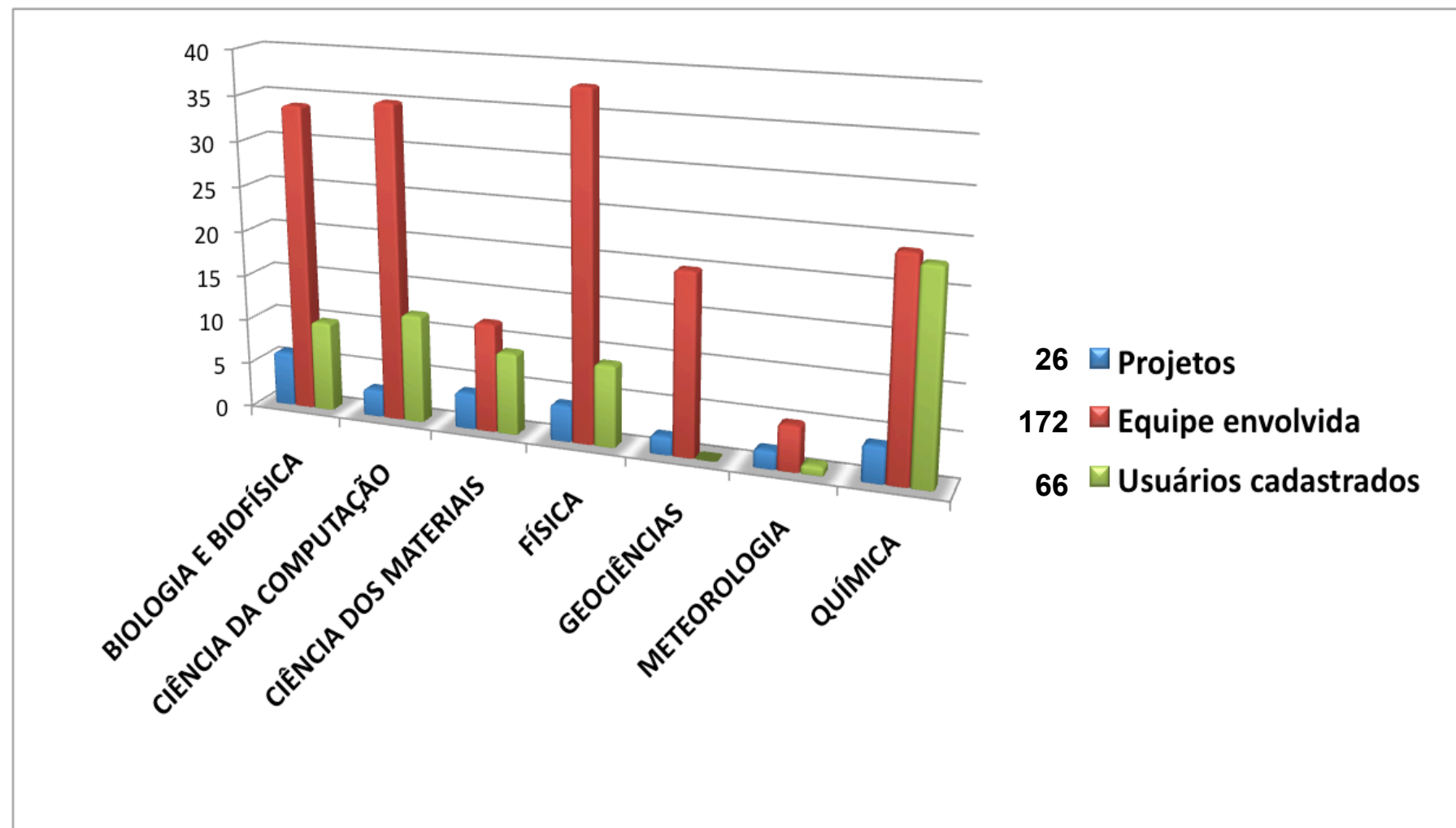
- 16,5 Gbps peak (2 X 8,26)
- Sustained for 1+ hour



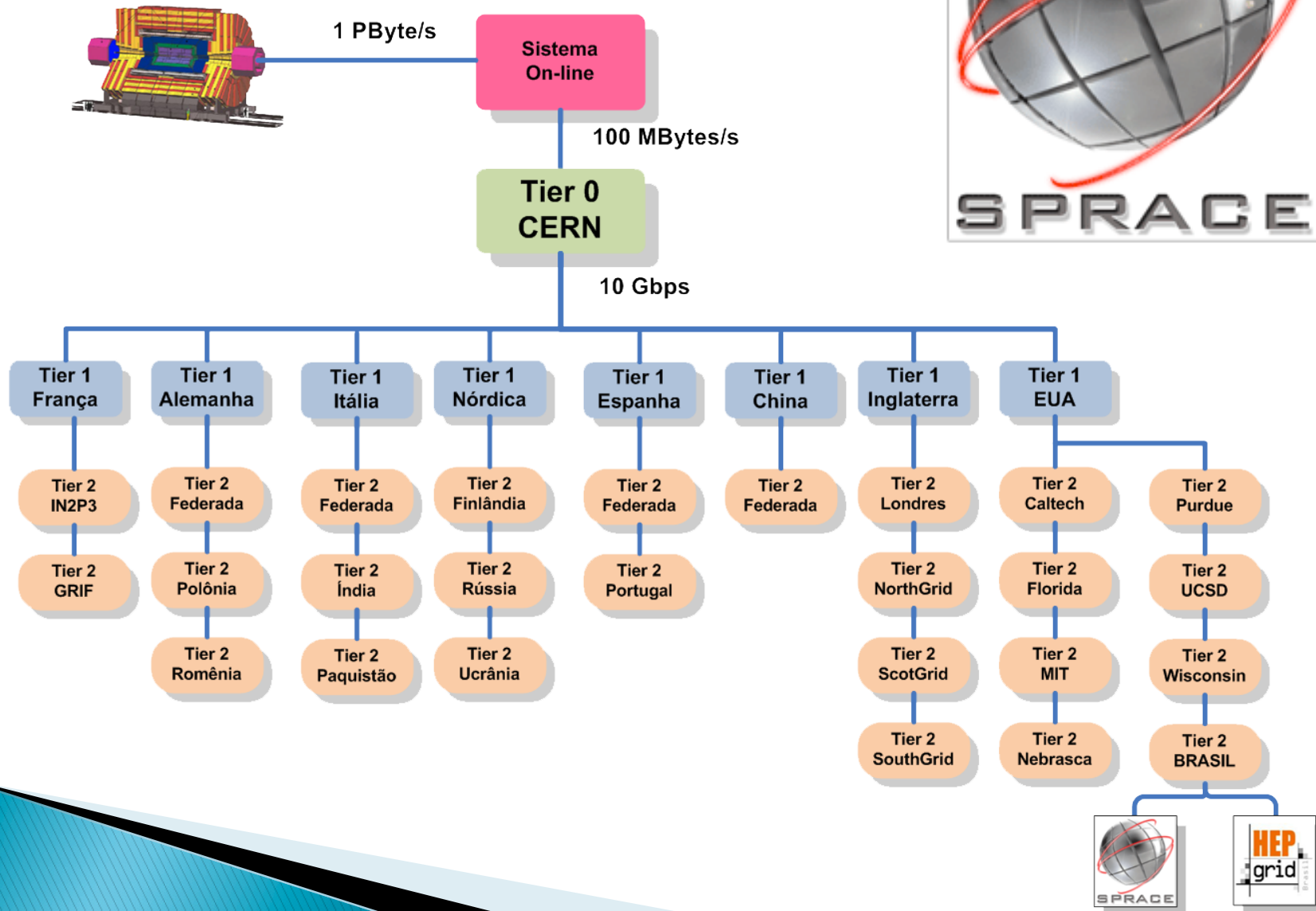
# 26 Scientific Projects



# Projects and Researchers



# SPRACE: WLCG Tier-2







## Tier-2 Availability and Reliability Report

Federation Summary - Sorted by Name

October 2010



Federation	Reli- ability	Avail- ability
BR-SP-SPRACE	100 %	100 %
FR-GRIF	100 %	100 %
FR-IN2P3-LPC	100 %	100 %
KR-KISTI-T2	100 %	100 %
KR-KNU-T2	100 %	100 %
T2_US_Caltech	100 %	100 %
US-AGLT2	100 %	100 %
US-NET2	100 %	100 %
T2_US_UCSD	100 %	100 %
DE-DESY-ATLAS-T2	100 %	100 %
CZ-Prague-T2	100 %	100 %
US-MWT2	100 %	100 %
FR-IN2P3-SUBATECH	100 %	100 %
AT-HEPHY-VIENNA-UIBK	100 %	100 %
US-SWT2	100 %	97 %
ES-LHCb-T2	99 %	99 %
DE-DESY-LHCB	99 %	99 %
FR-IN2P3-CPPM	99 %	99 %
T2_US_MIT	99 %	98 %
DE-DESY-RWTH-CMS-T2	99 %	99 %
IN-DAE-KOLKATA-TIER2	99 %	86 %
TR-Tier2-federation	98 %	98 %
CH-CHIPP-CSCS	98 %	96 %
UK-SouthGrid	98 %	98 %
RU-RDIG	98 %	98 %
US-WT2	97 %	92 %
T2_US_Florida	97 %	97 %
DE-MCAT	97 %	97 %
AU-ATLAS	97 %	97 %
CA-EAST-T2	97 %	97 %
JP-Tokyo-ATLAS-T2	96 %	89 %
BE-TIER2	96 %	96 %
FR-IN2P3-CC-T2	96 %	96 %

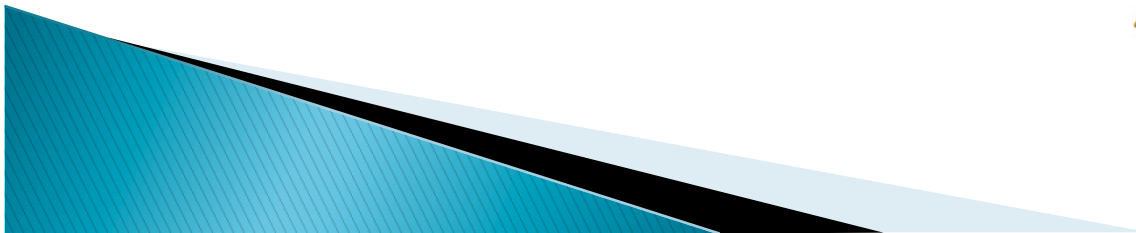
Federation	Reli- ability	Avail- ability
IT-LHCb-federation	96 %	95 %
PL-TIER2-WLCG	96 %	96 %
ES-ATLAS-T2	96 %	96 %
UK-ScotGrid	95 %	94 %
UK-London-Tier2	95 %	95 %
ES-CMS-T2	95 %	95 %
T2_US_Purdue	95 %	93 %
DE-FREIBURG WUPPERTAL	94 %	94 %
CN-IHEP	94 %	90 %
PK-CMS-T2	94 %	93 %
T2_US_Nebraska	94 %	93 %
SE-SNIC-T2	94 %	94 %
CA-WEST-T2	94 %	94 %
HU-HGCC-T2	93 %	92 %
IT-ALICE-federation	91 %	91 %
IT-ATLAS-federation	91 %	91 %
IT-CMS-federation	91 %	91 %
PT-LIP-LCG-Tier2	91 %	91 %
FR-IN2P3-IPHC	90 %	90 %
RO-LCG	89 %	89 %
DE-DESY-GOE-ATLAS-T2	89 %	89 %
FR-IN2P3-LAPP	88 %	88 %
NO-NORGRID-T2	88 %	88 %
SI-SIGNET	84 %	84 %
T2_US_Wisconsin	83 %	79 %
TW-FTT-T2	80 %	80 %
UK-NorthGrid	77 %	77 %
IL-HEPTier-2	75 %	75 %
FI-HIP-T2	70 %	70 %
EE-NICPB	58 %	58 %
IN-INDIACMS-TIFR	52 %	47 %
DE-GSI	N/A	N/A
UA-Tier2-Federation	N/A	N/A

# What Lies Ahead

- ▶ Open Science Data Cloud



- ▶ Principal Investigator
  - Robert Grossman
  - University of Chicago



# Open Cloud Consortium

## ▶ Research

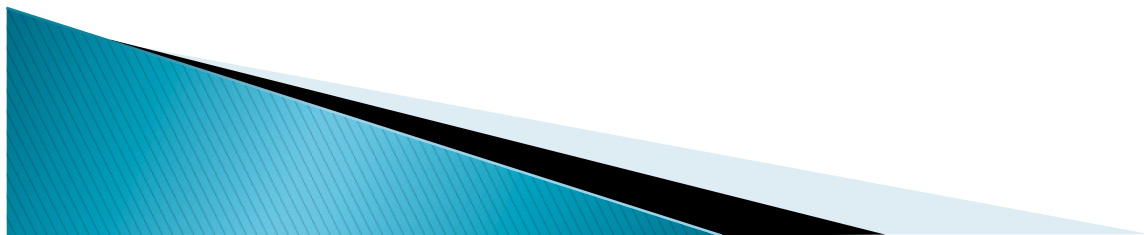
- Cloud middleware for data intensive computing
- Wide area clouds

## ▶ Training and education workshops

- Data intensive computing using the OSDC
- Cloud computing for scientific computing

## ▶ Outreach

- OSDC Data Challenge
- Awareness Workshops to recruit work force



# UNESP Participation

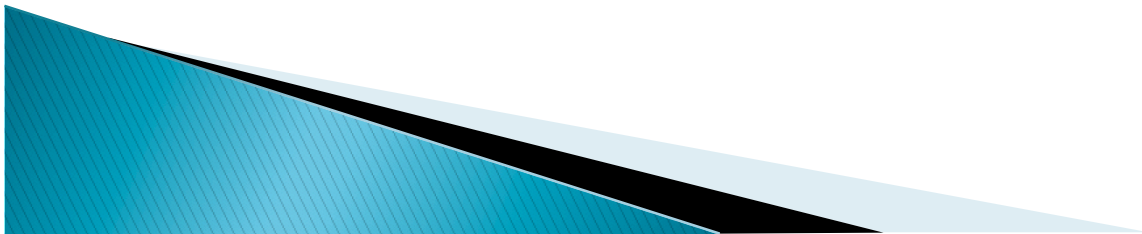
## ▶ Partners

- Beijing Institute of Genomics, **China**
- Edinburgh University, **UK**
- **Korea** Institute of Science & Technology
- National Institute of Advanced Industrial Science and Technology, **Japan**
- UNESP & UFF, **Brazil**
- University Amsterdam, **Netherlands**

- ▶ Provide some computers to the OSDC structure
- ▶ Exchange of graduate students to work with one of the partners
- ▶ Send graduate students to hands-on Workshops
- ▶ Submit datasets to the OSDC Data Challenge
  - Annual contest to select datasets to add to the OSDC

# Thanks to our team

- José Roberto B. Gimenez
- Rogério L. Iope
- Sérgio M. Lietti
- Matheus P. Lobo
- Carlos Eduardo S. Moreira
- Jadir M. da Silva
- Allan Szu
- Gabriel A. von Winckler





# Thank You

