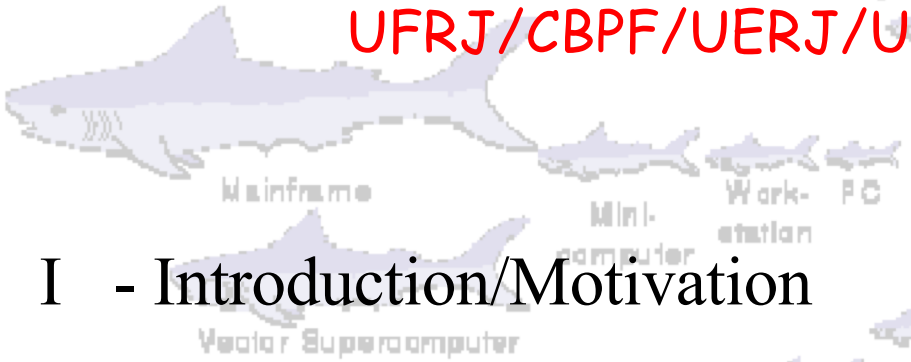
HEPGRID

Alberto Santoro,
IF / UERJ
Mario Vaz
LAFEX/CBPF LPC / EE / UFRJ
speaking for
UFRJ/CBPF/UERJ/UFRGS/USP/UNESP



I - Introduction/Motivation

II - New Initiatives

III –Conclusion

Valdivia- April - 2002

GRID WORKSHOP

Grid Projects

GriPhyN → approved $12M

(Grid Physics Network)

EU DataGrid approved, $9.3M

iVDGL preproposal → $ 14 M

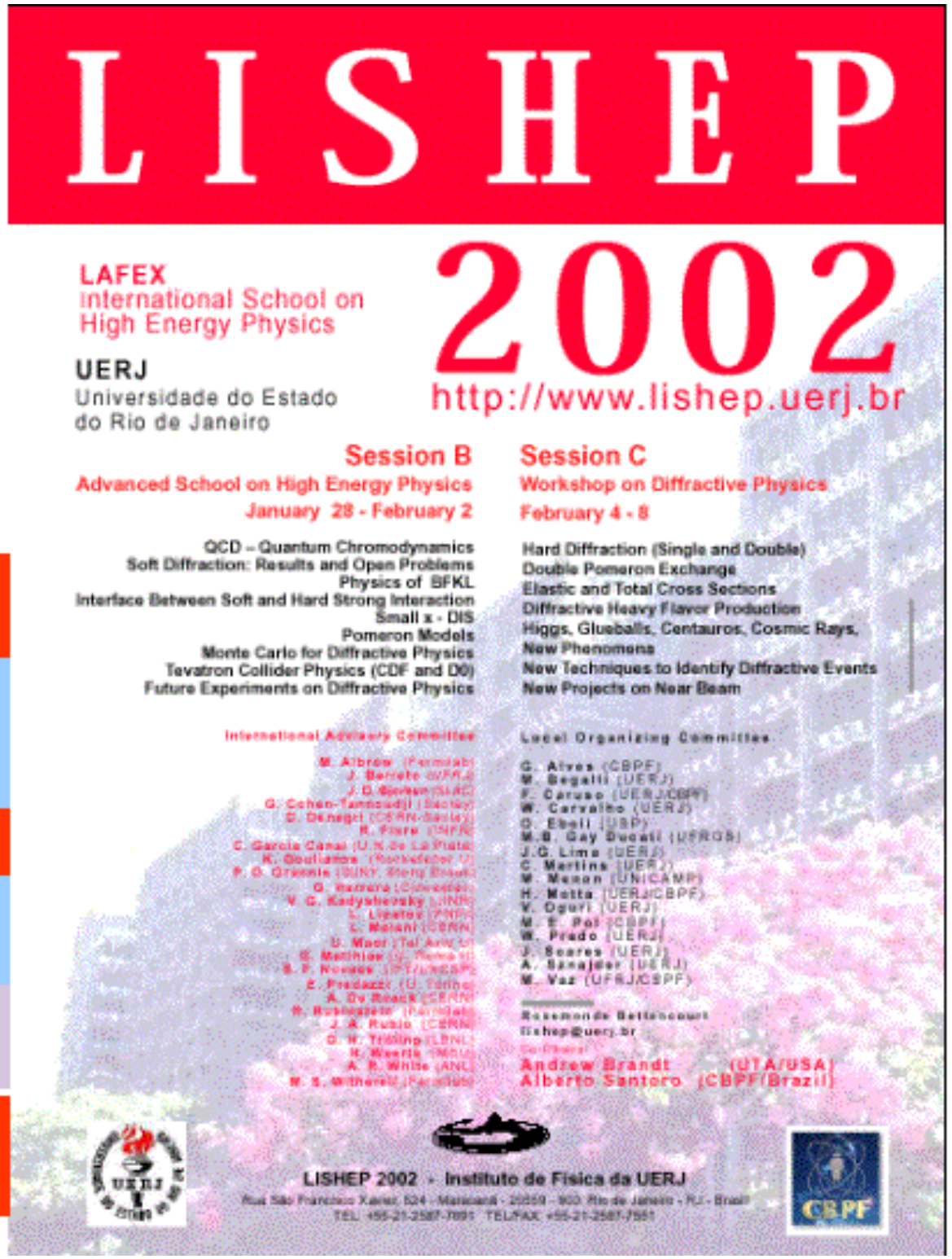
(International Virtual-Data Grid Laboratory)

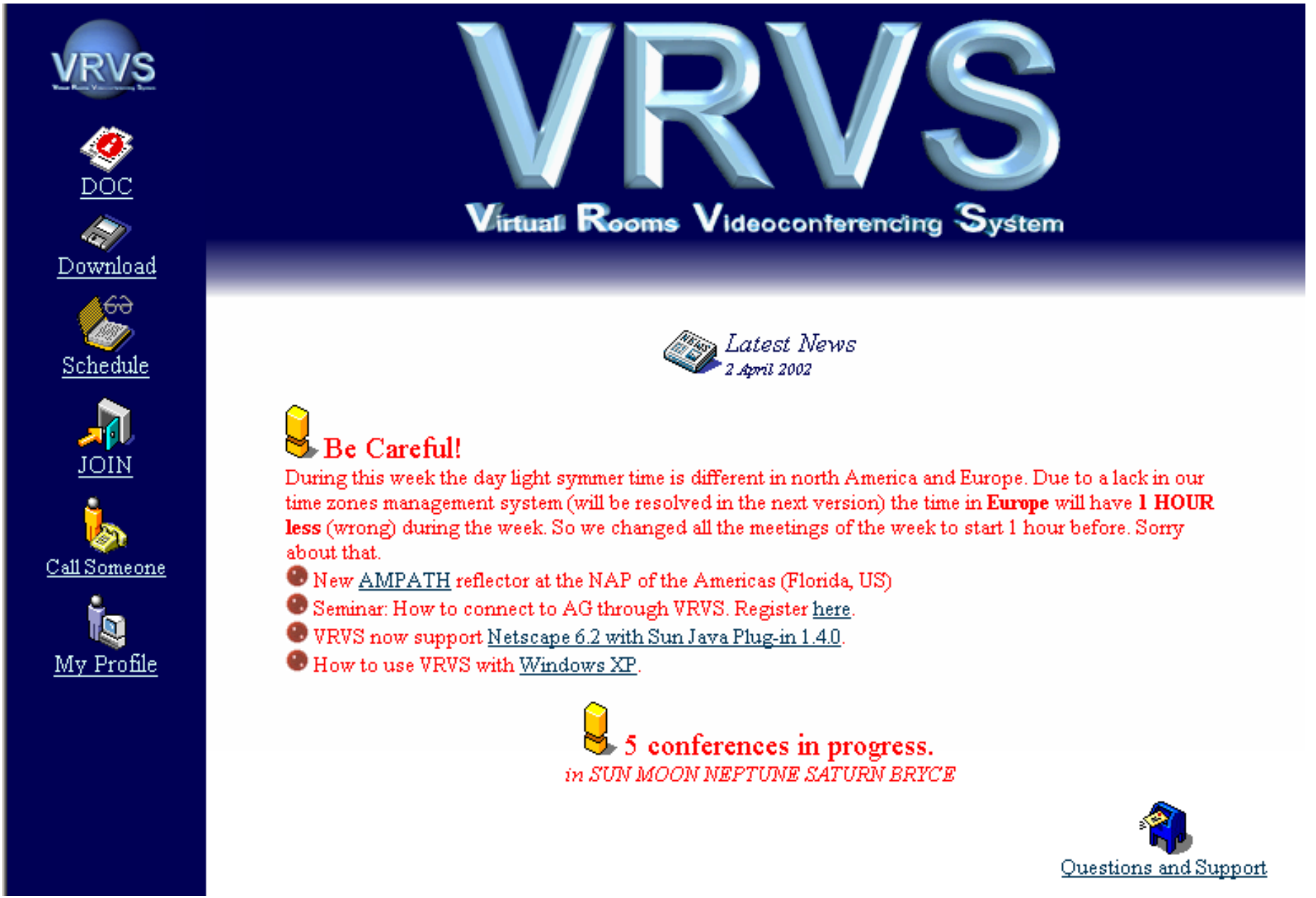
PPDG → approved $9.5M

(Particle Physics Data Grid)

DTF → approved, $ 53 M

Data Terascale Facilities





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- April 12 2002 -Valdivia, Chile

I - INTRODUCTION

Why a HEPGRID in Brazil? – A colaboration between Science and Technology

Projects Done

1. Heterogeneous Network (VMS+NOVELL+UNIX+WINDOWS) (1986)
2. ACP1, ACP2, ACPMAPS – Fermilab Collaboration.
   Physicists and Engineers
   worked together –1986-1994
3. CPS (Mariano Miranda and Fermilab collaborators) - 1994
4. CHEP95 – Use Videoconference – Internacional (1995)
6. Client/Server - FARM-IBM – (Collider: D0, Monte Carlo
   Production, too advanced -1997

Outside of this let us show what are our motivation

Why in HEP we develop hardware and software?
Why is the computer necessary?

1. Particle Accelerators
   - -Simulation
   - -Design
   - -Control, Monitoring and Safety

2. Detectors
   - -Simulation
   - -Design
   - -Control & Monitoring

3. Data Acquisition
   - -Eletronics & Triggers
   - -Online Programming
   - -Data record

4. Data Reconstruction
   - -Fast Processors
   - -Read, Write, and Storage

5. Software for several aplications (low and high Level)

6. Communication
   - -networks
   - -email
   - -WWW

7. Data Analysis
   Including Distributed and Shared
   (CPU, Storage, Bandwidth)

8. In General : CERNLIB, Monte Carlo, Virtual Reality

For High Energy Physicists:

Old Parameters

- **Space** → 10^{-13}cm - 10^{-18} cm
- **Time** → From 10^{-12} seg. To 10^{-23} seg.
- **Velocities** → C = 300.000 km/seg

New Parameters

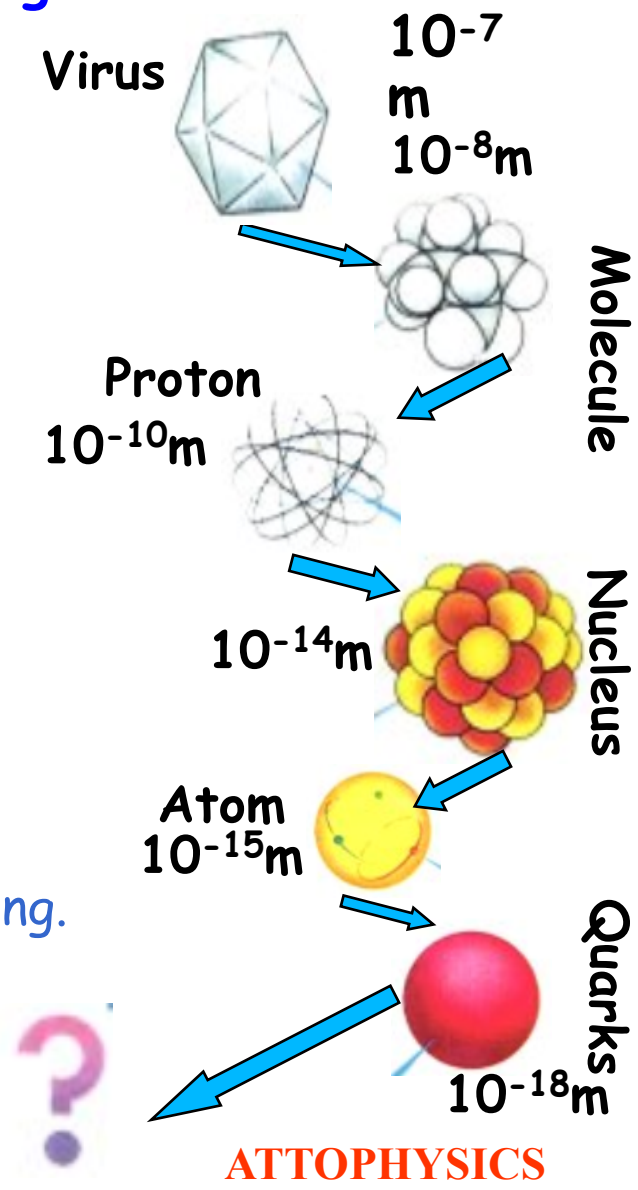
Data Storage → Petabytes = 10^{3} Terabytes

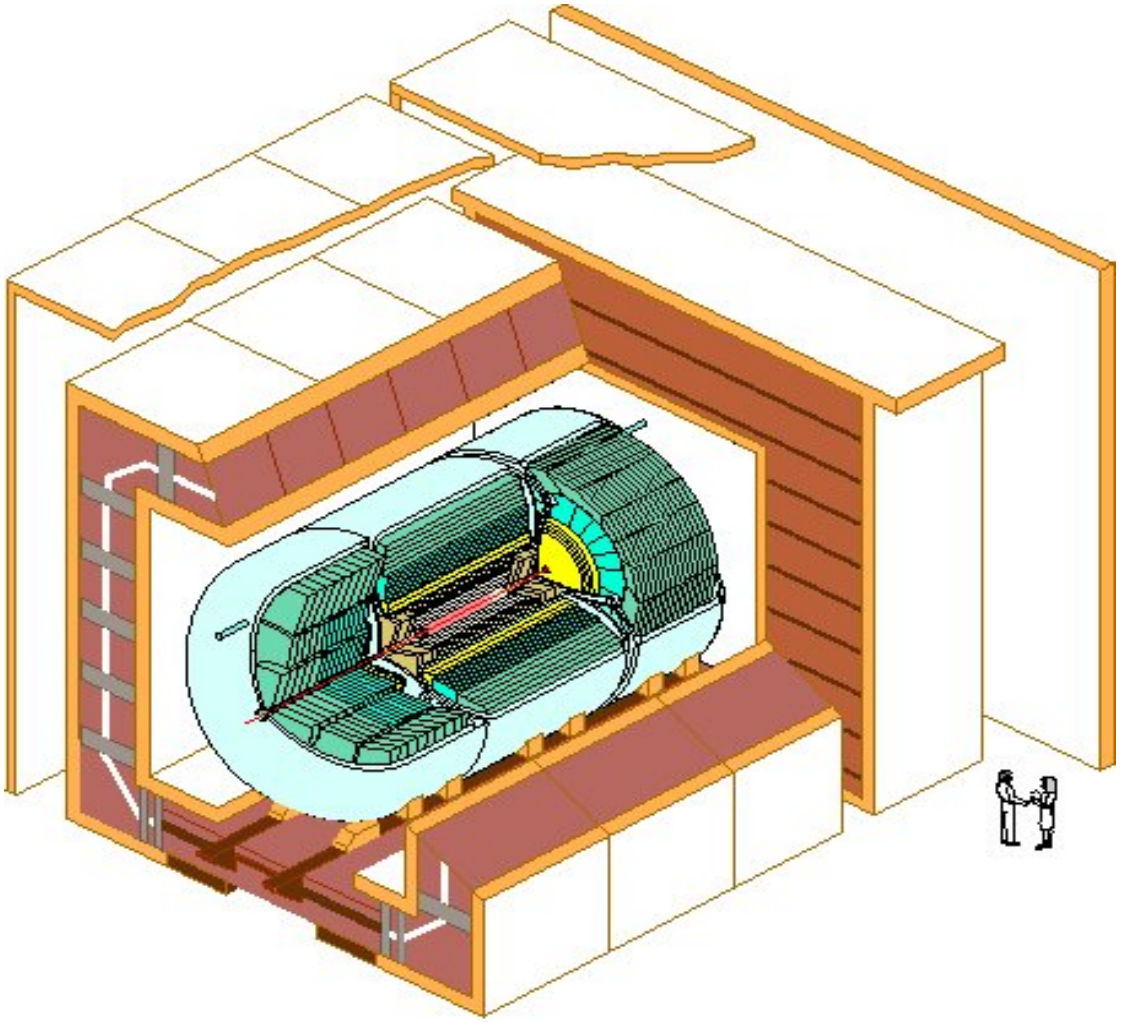
Links → 600 Megabites/s - 2 Gigabites/s

Number of Physicists per Decade

→ Increase and Organizing

Years	60	→ 20 - 40	Phys. & Eng.
	80	→ 400 - 600	
	00	→ 1800 - ?	





DØ Detector

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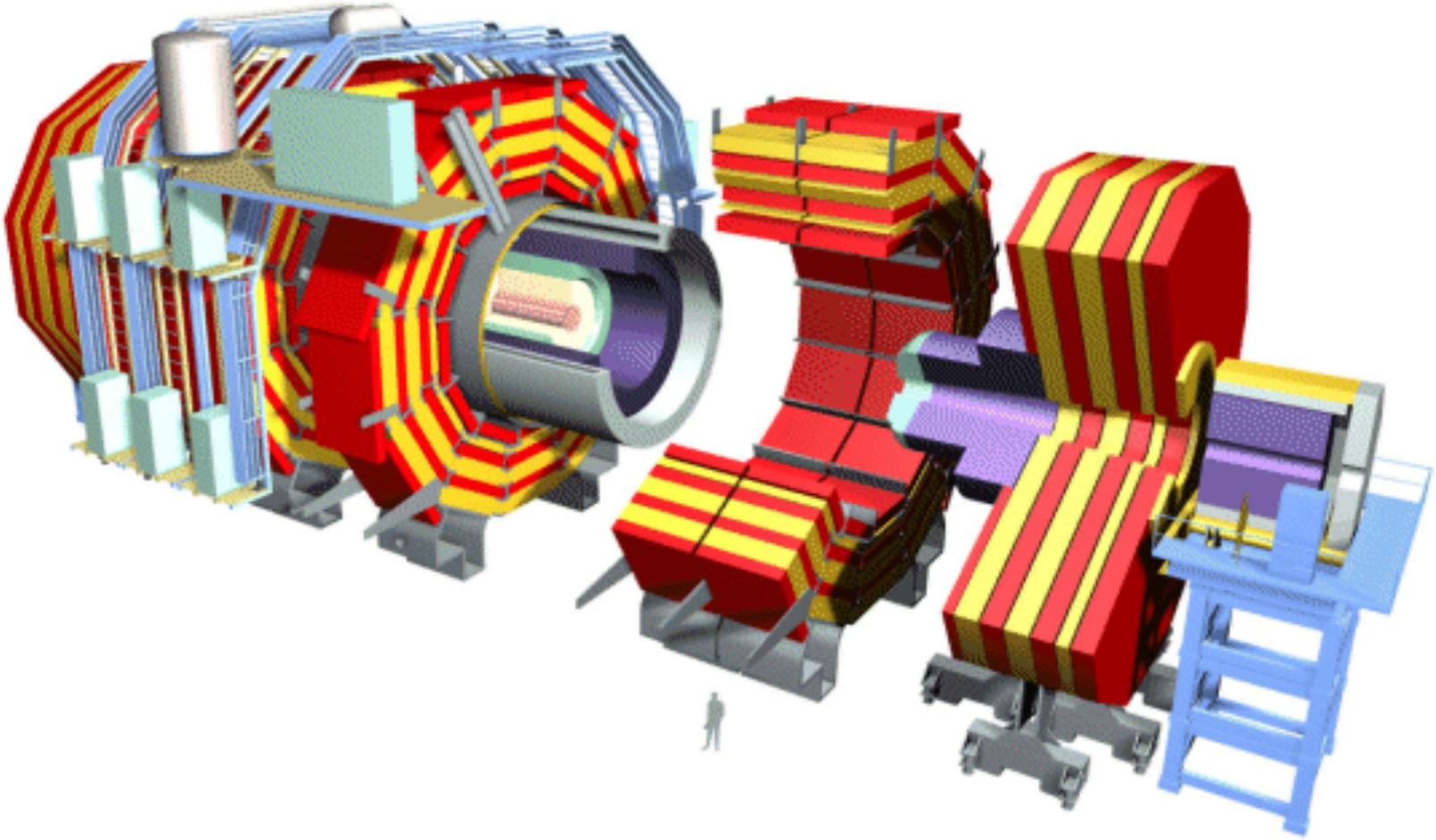
COMPACT MUON SOLENOID



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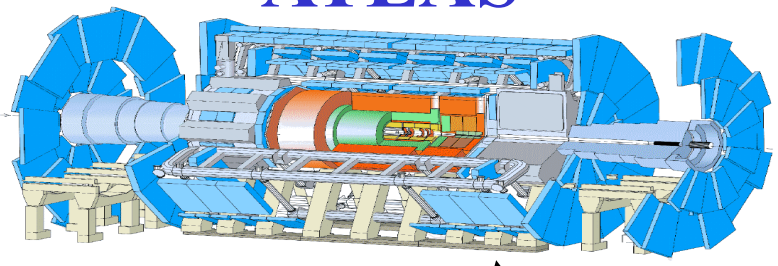
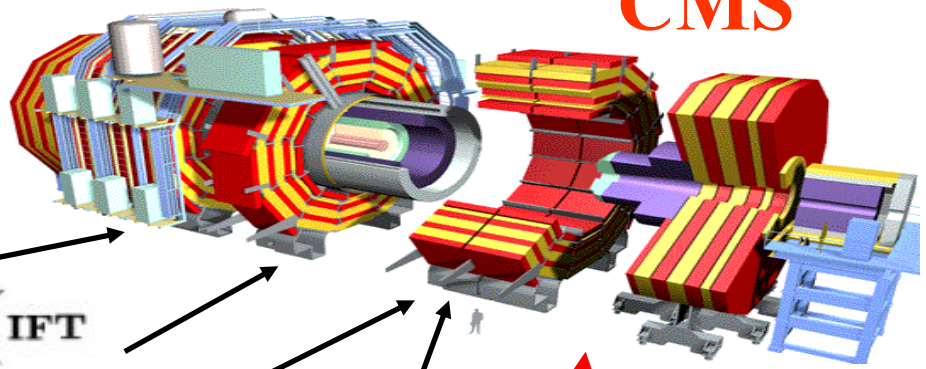
ATLAS



CMS



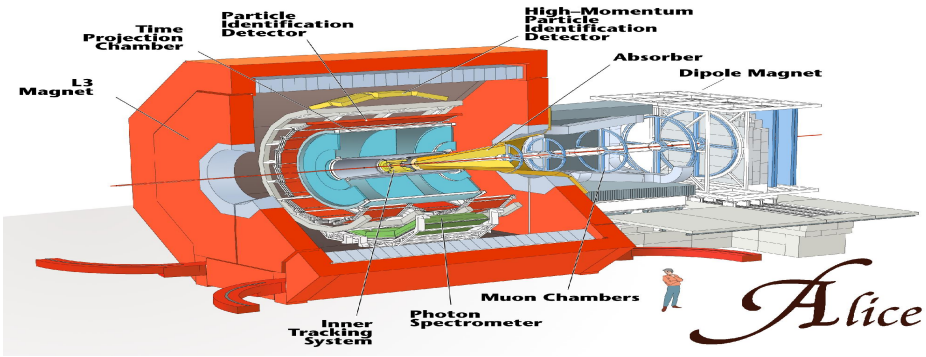
IFT

unesp

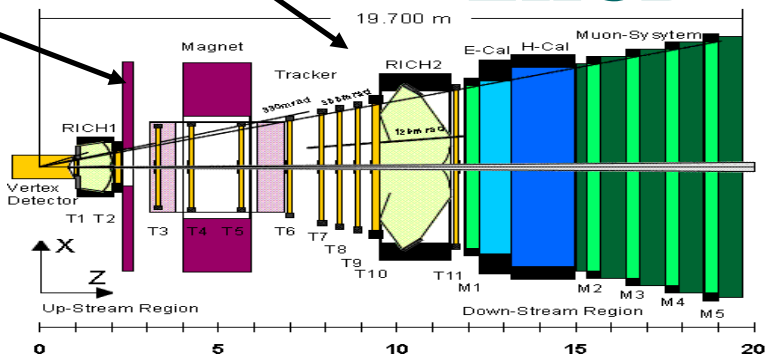
UFRJ
Universidade Federal do Rio de Janeiro

CBPF

UERJ



LHCB



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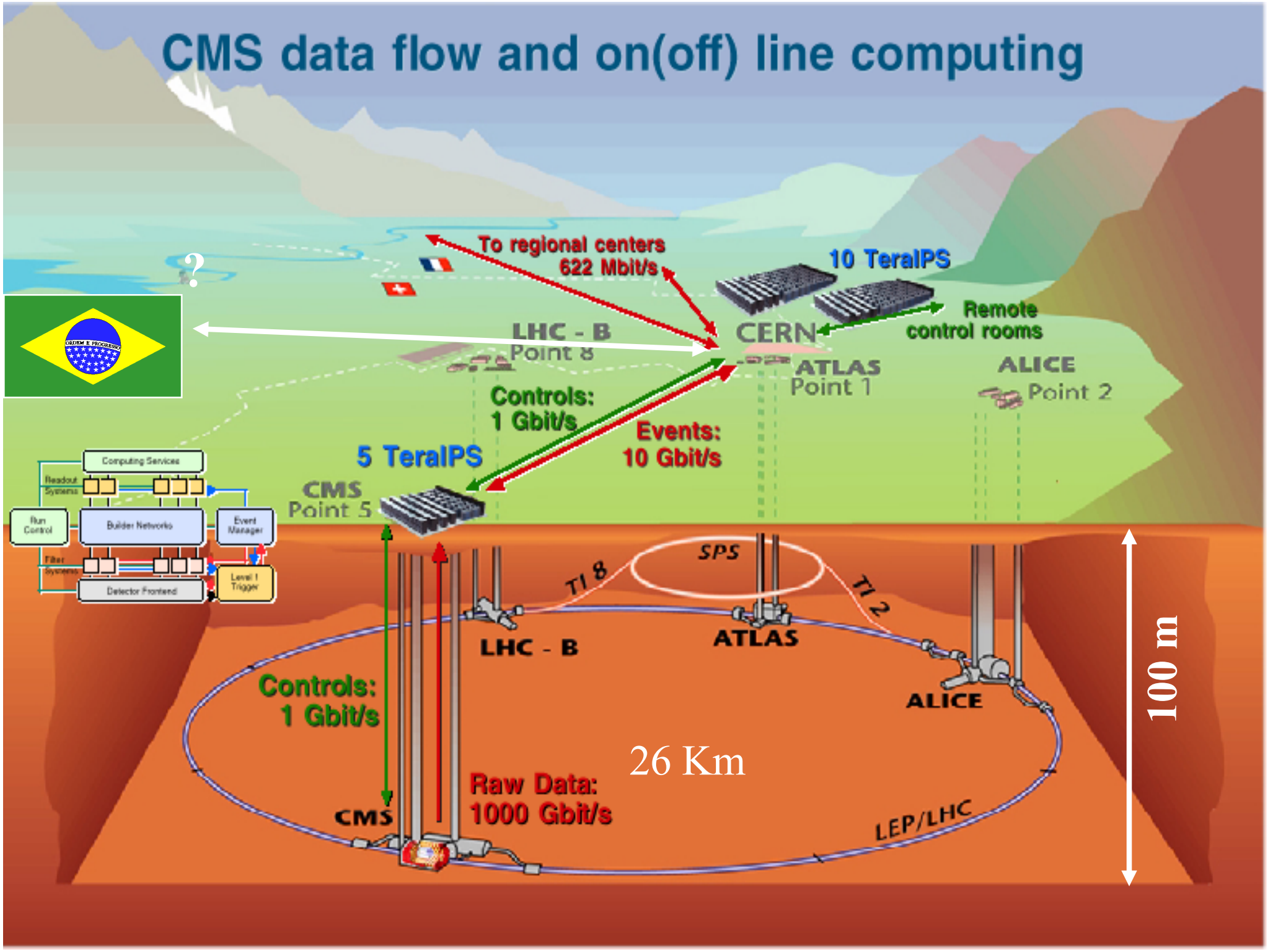
II - New Initiatives

Participation on GRID – Tiers 1

The challenge is big!
The first one is to build and Expand a Scientific/Technical Collaboration at 3 levels:
Regional, National and International

As a TOOL for the development

Then, an Unit of GRID in Brazil will be the CORE to turn possible Scientists and Technicians to work on NEW Experiments


CMS data flow and on(off) line computing
?
To regional centers
622 Mbit/s
10 TeraIPS
Remote
control rooms
LHC - B
Point 8
CERN
ATLAS
Point 1
ALICE
Point 2
Controls:
1 Gbit/s
Events:
10 Gbit/s
5 TeraIPS
CMS
Point 5
Computing Services
Readout
Systems
Run
Control
Builder Networks
Event
Manager
Filter
Systems
Level 1
Trigger
Detector Frontend
SPS
TI 8
TI 2
LHC - B
ATLAS
ALICE
Controls:
1 Gbit/s
26 Km
Raw Data:
1000 Gbit/s
CMS
LEP/LHC
100 m

Distributed Analysis System Organization

A possible model for Brazilian Unity

100MB/s On line system

Offline Farms 20 TIPS

CERN

650K SI95
20 TIPS (~10KPCs)
540 Tbytes disk
Robots

T0

4 - 7 TIPS
110 TB disk
National Centers
2000 PCs

T1

622 MB/s → ~GB/s

~7TIPS

France

Germany

Italy

BRAZIL

622 MB/s

USA

~4 TIPS
only for CMS

2.4 Gb/s

0.25 TIPS
~TB disk
100 PCs

T3

622 Mb/s

Regional Centers

T2

1 TIPS - 25K SI95
20 TB disk - 250 PCs

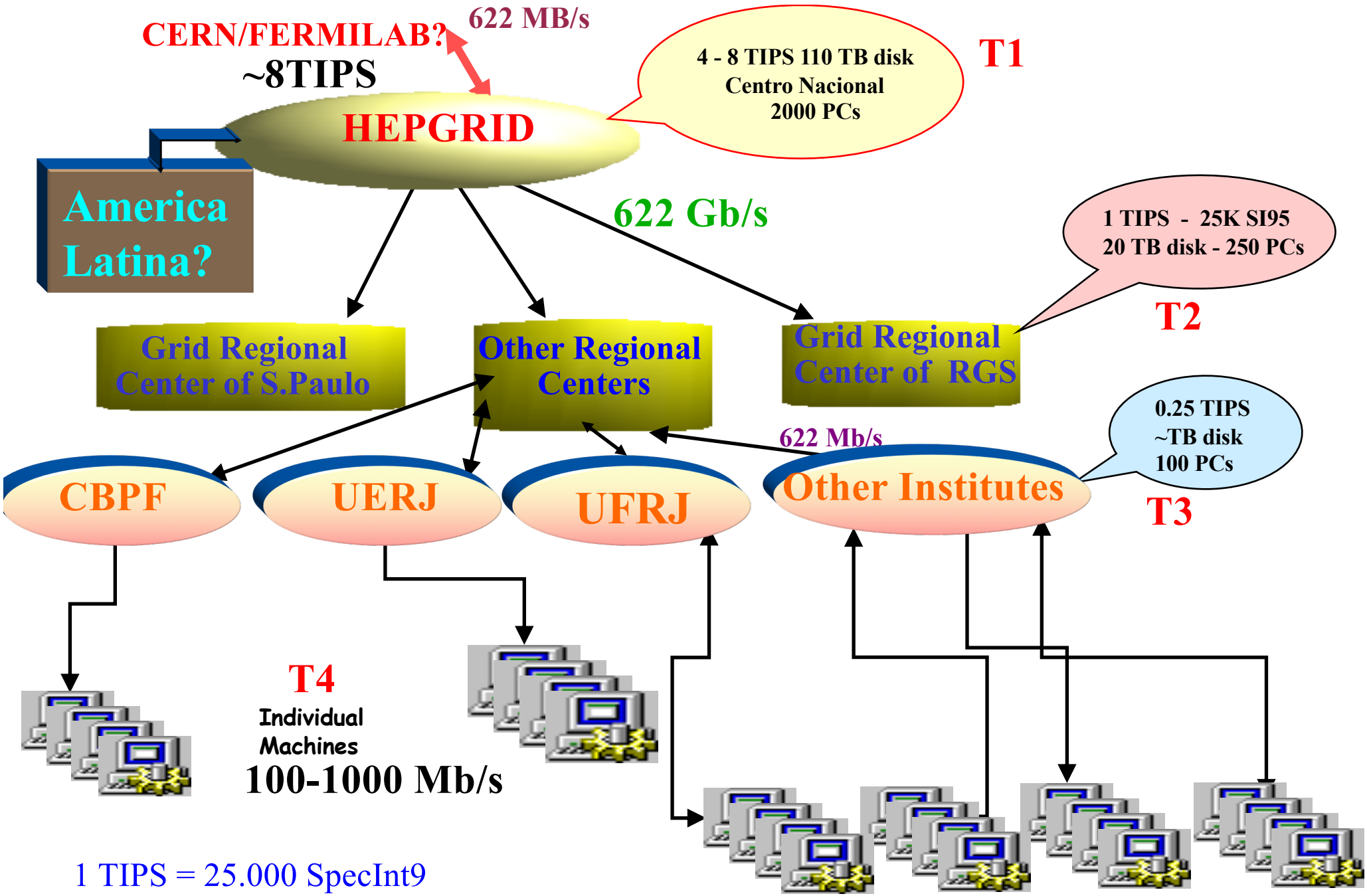
Institutes

100-1000 Mb/s

T4
Individual Machines

1 TIPS = 25.000 SpecInt9
1 PC(2 GHz) ~ 100 SpecInt95

2000 Pcs = 8 TIPS



1 TIPS = 25.000 SpecInt9
1 PC(2 GHz) ~ 100 SpecInt95

2000 Pcs = 8 TIPS

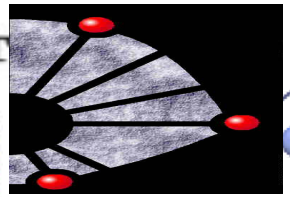
Partners ?

LOCAL → DFNAE + IF + CTC + EE + …….

Regional →

Nacional →

UFBA



UNICAMP

Internacional →

. . . . . .

Some possible topics getting together Science and Technologies – Mainly among Brazilian groups:

-Networks at (600 MB - 2 GB….10 GB) Training

-Parallel Processes with thousands of CPUs

-Storage and Management of Large amount of Data (Petabytes)

-Distribution and Access to Data for Physics Analysis

-Management of Thousand Computers

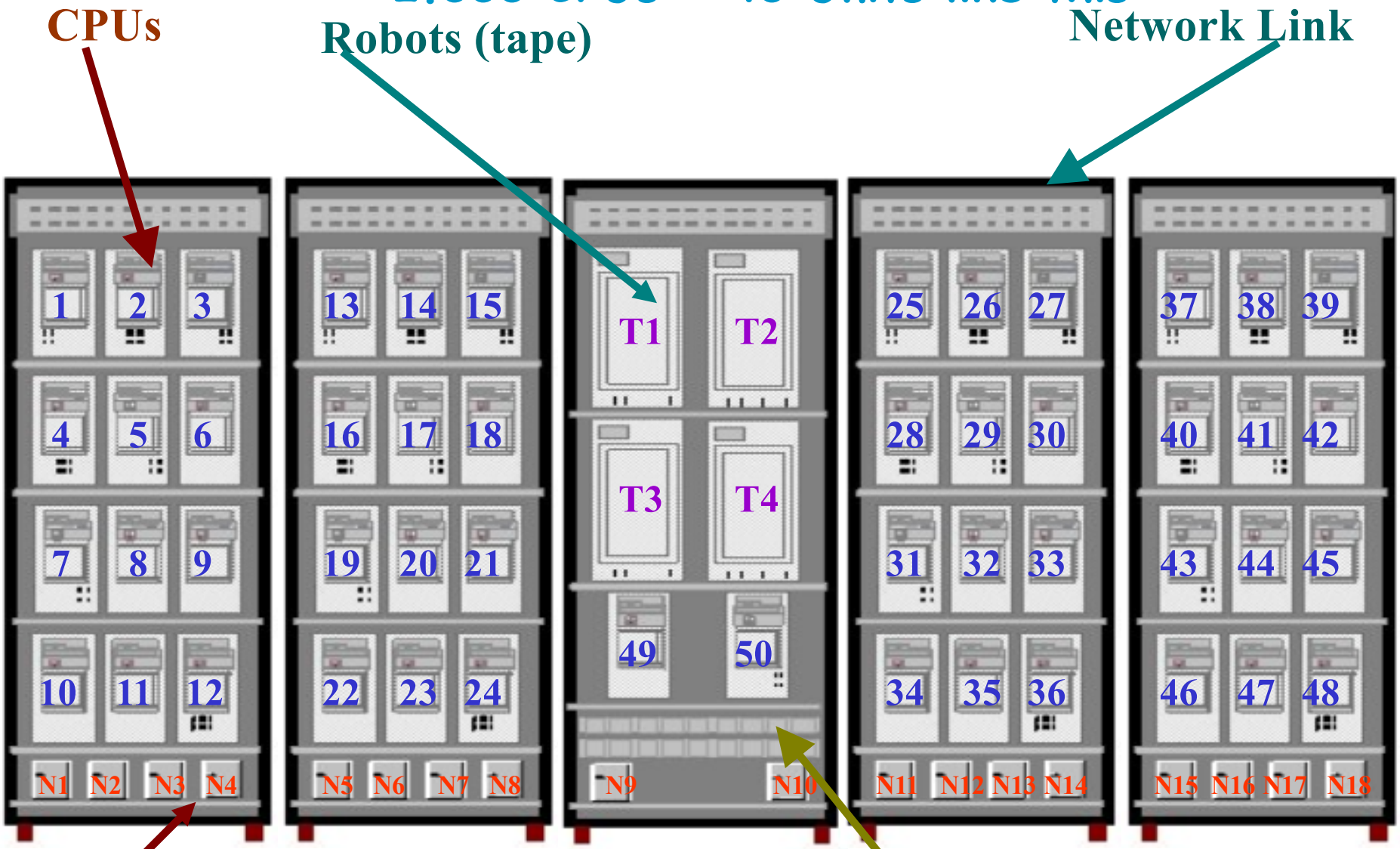
-Scientific Software Development

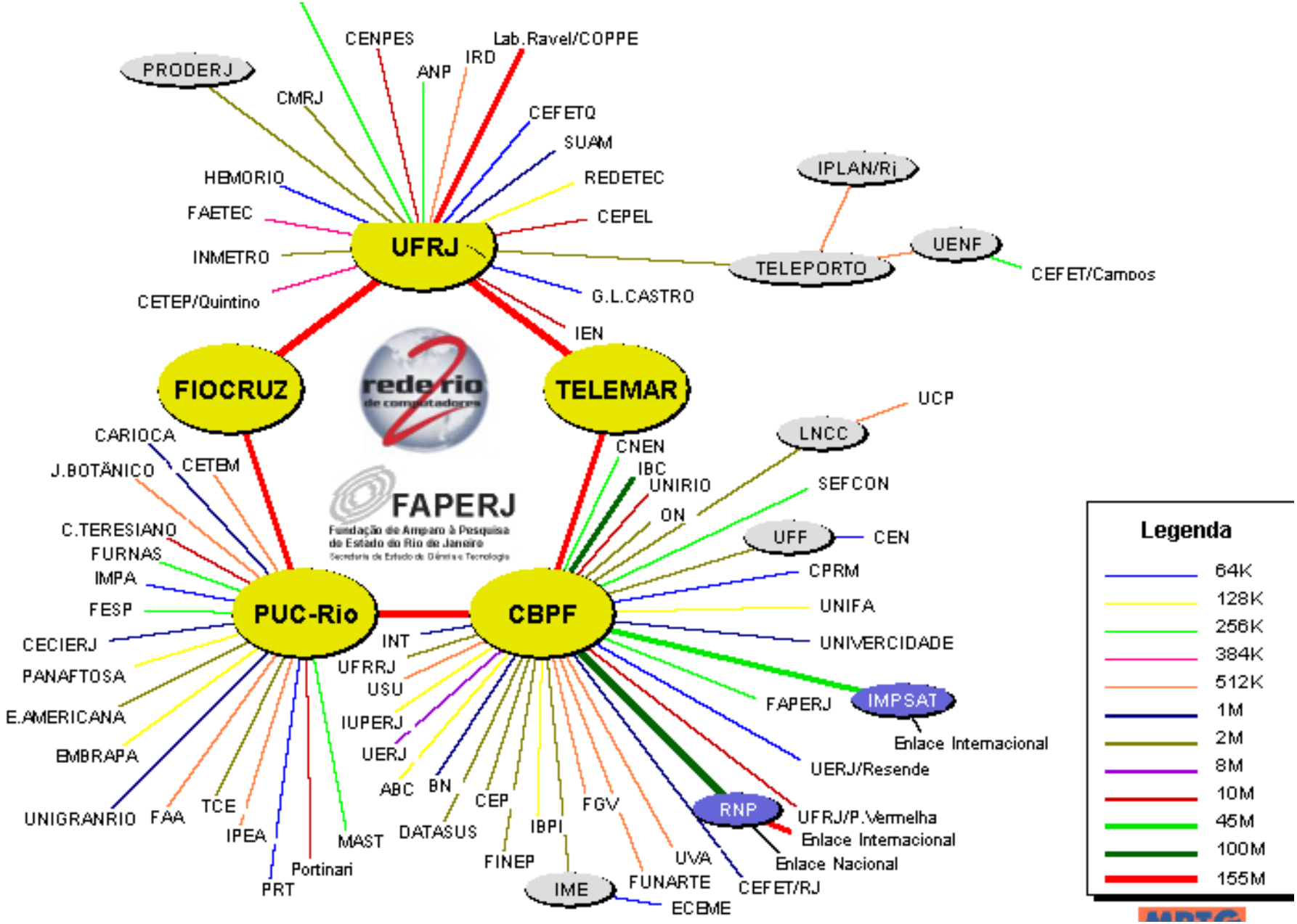
-Diffractive Physics, Top, Higgs...,DZEO group

- Electronics Developments

Possible Prototype for one first Unit

2.000 CPUs = 40 Units like this




CENPES
Lab.Ravel/COPPE
IRD
ANP
PRODERJ
CMRJ
CEFETQ
SUAM
HEMORIO
REDETEC
FAETEC
CEPEL
IPLAN/Rj
UFRJ
INMETRO
TELEPORTO
UENF
CEFET/Campos
CETEP/Quintino
G.L.CASTRO
IEN
FIOCRUZ
TELEMAR
rederio de computadores
UCP
LNCC
CARIOCA
CNEN
J.BOTÂNICO
CETEM
IBC
UNIRIO
SEFCON
FAPERJ
Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro
ON
C.TERESIANO
UFF
CEN
FURNAS
CPRM
IMPA
UNIFA
FESP
PUC-Rio
CBPF
UNIVERCIDADE
CECIERJ
INT
PANAFTOSA
UFRRJ
FAPERJ
IMPSAT
USU
E.AMERICANA
IUPERJ
Enlace Internacional
EMBRAPA
UERJ
UERJ/Resende
ABC
BN
CEP
FGV
RNP
UFRJ/P.Vermelha
UNIGRANRIO
FAA
TCE
DATASUS
IBPI
Enlace Internacional
IPEA
MAST
UVA
Enlace Nacional
Portinari
FINEP
PRT
IME
FUNARTE
CEFET/RJ
ECEME
Legenda
64K
128K
256K
384K
512K
1M
2M
8M
10M
45M
100M
155M

Rede Rio

Virtual Institute for the Study of Fundamental Interactions

A. Santoro
UERJ/RIO

Rio 2002
GRID WORKSHOP

Outline

I - Introduction / Motivation

II - Present Status

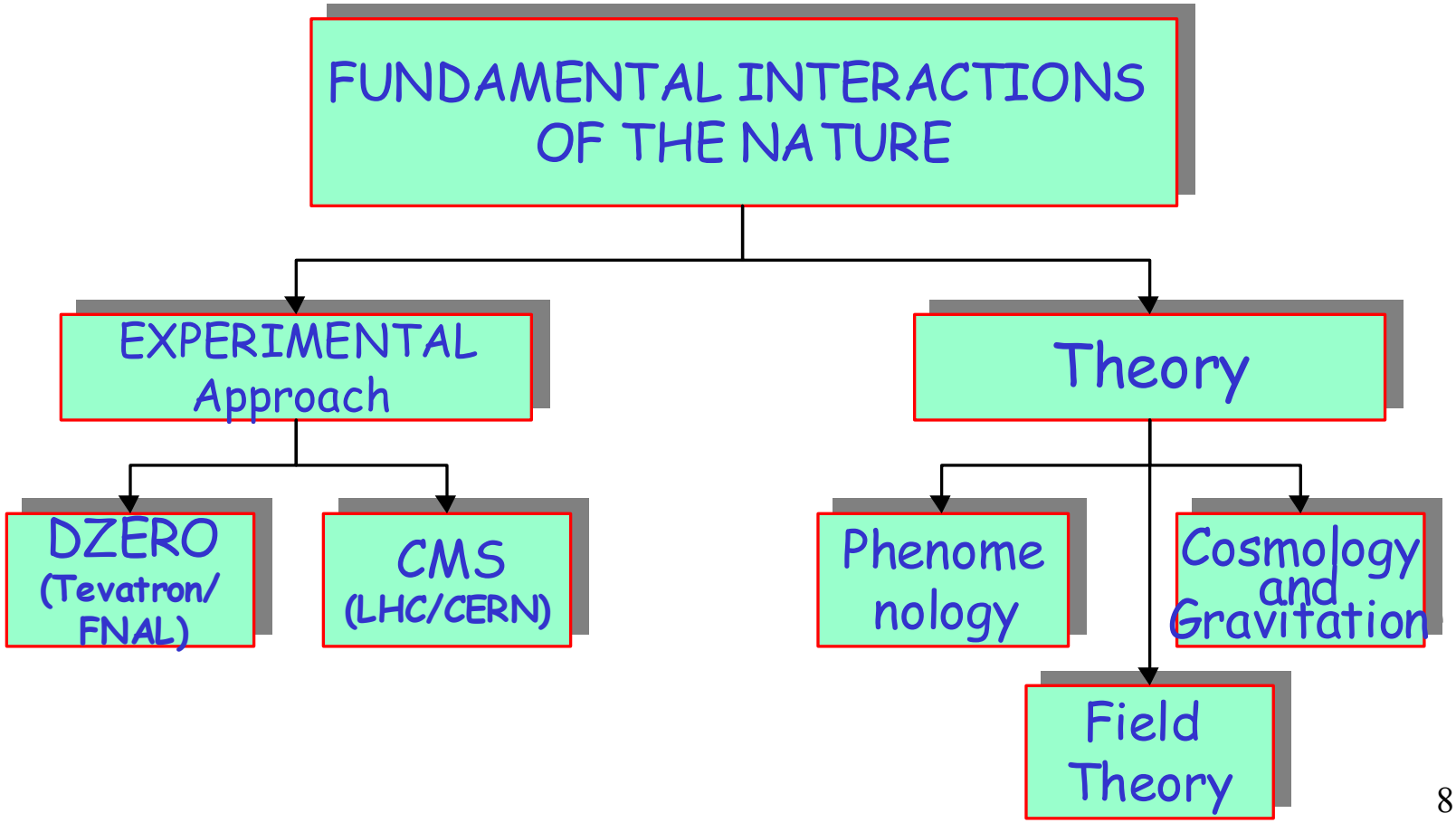
III - Prospects/Conclusion

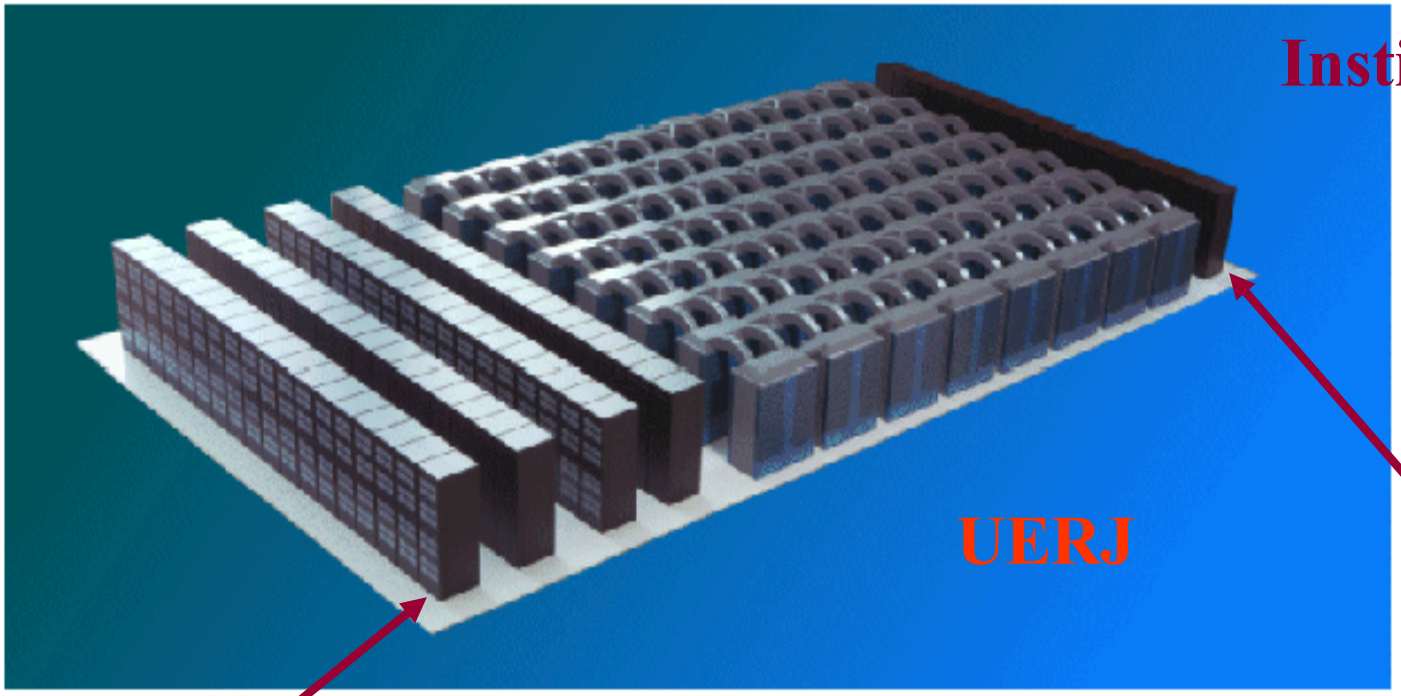
Institutions	Departments
Centro Brasileiro de Pesquisas Físicas	LAFEX
Universidade Federal do Rio de Janeiro	Departamento de Física Teórica
	Departamento de Física Nuclear
	Department of Electronics
Universidade Estadual do Rio de Janeiro	Depart. de Física Nuclear e Altas Energias
Universidade de São Paulo	Departamento de Física Experimental
	Departamento de Física Matemática
	Departamento de Física Nuclear
Universidade Estadual Paulista	Instituto de Física Teórica
	Depart. de Física e Química/Guaratinguetá
Universidade Estadual de Campinas	Depart. de Raios Cósmicos e Cronologia
	Institute of Mathematics
Universidade Federal do Rio Grande do Sul	Departamento de Física
Universidade Federal de Pelotas	Departamento de Física
Universidade Federal da Bahia	Departamento de Física do Estado Sólido
Universidade Federal do Espírito Santo	Departamento de Física
Universidade Federal de Juiz de Fora	Departamento de Física
Escola Federal de Engenharia de Itajubá	Departamento de Física e Química

International Collaborators of the Virtual Institute

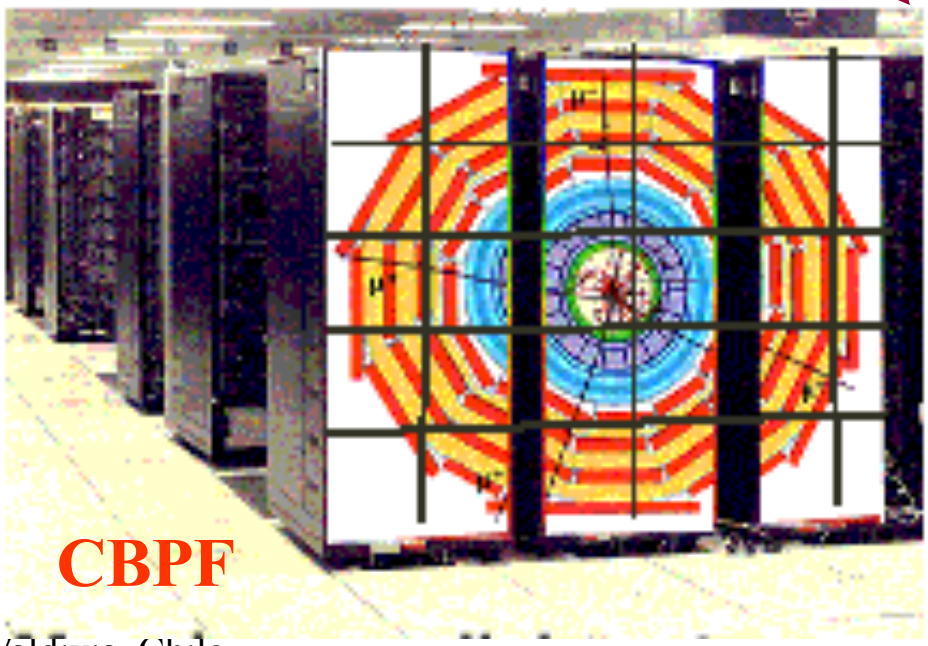
Argentina	Israel	Portugal	Sweden
Chile	Italy	Spain	United States
France	Germany	Russia	Uzbequistan

Groups of Research by Topic

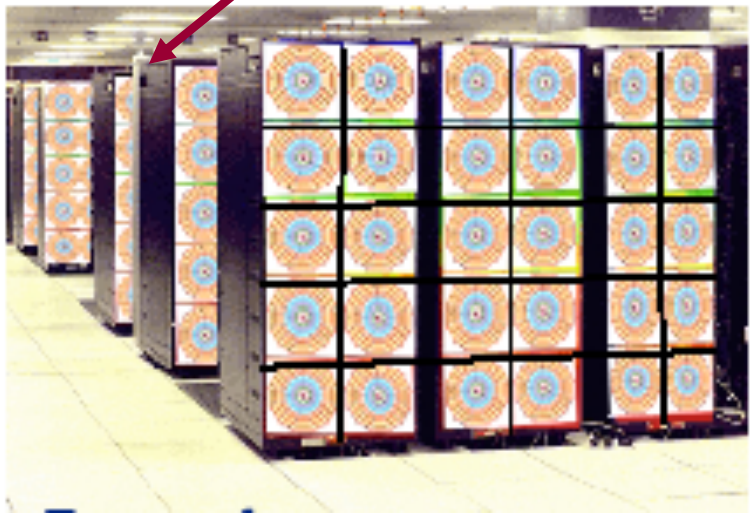




Institute/Univ. 3



Institute/Univ. 2



IFT
USP
UFBA
UFRGS
UFRJ
.....

III - CONCLUSION - 1

- HEPGRID is a proposal for Research and Development bringing an estrategic relationship between Science and Technology

-HEPGRID will allow us to do

- Basic and Frontier Researches +
- Training people to work on this new world +
- Collaboration with Industry and Academy

III - CONCLUSION - 2

Our proposal for VISFI was not selected by the committee of the Institutes of the Millenium.

We had a meeting last October, and we decide to go ahead with another proposal.

VISFI ⟶ IVISFIN

International Virtual Institute for the Studies of the Fundamental Interactions of the Nature

To build the ideas about contact Prof. Santoro - santoro@fnal.gov

T0 = 1. 20 TIPS: CPU Power ~5000 PC (2GHz)
2. Armazenagem de Dados ~540 TB Raid Disks - Robôs
3. Serviços a definir

T1 = 1. 4 – 8 TIPS: CPU Power ~2000 PC (2GHz)
2. Armazenagem de Dados ~110 TB Raid Disks
3. Serviços a definir

T2 = 1. 1 TIP: CPU Power ~250 PC (2GHz)
2. Armazenagem de Dados ~20 TB Raid Disks
3. Serviços a definir

T3 = 1. 0.25 TIP: CPU Power ~100 PC (2GHz)
2. Armazenagem de Dados ~10 TB Raid Disks
3. Serviços a definir

T4 = 1. Um ou um Conjunto de Desktops. Máquinas individuais
2. Armazenagem de Dados não definida
3. Serviços a definir

- Sistema Operacional : LINUX OS

Regional Center and Grid Development in Brazil

Cláudio Geyer - geyer@inf.ufrgs.br

GPPD - Parallel and Distributed Computing Group

Instituto de Informática - UFRGS

Mario Vaz - mariovaz@cbpf.br

LAFEX - Cosmology and Experimental High Energy Physics Laboratory - CBPF

Brazil

Authors

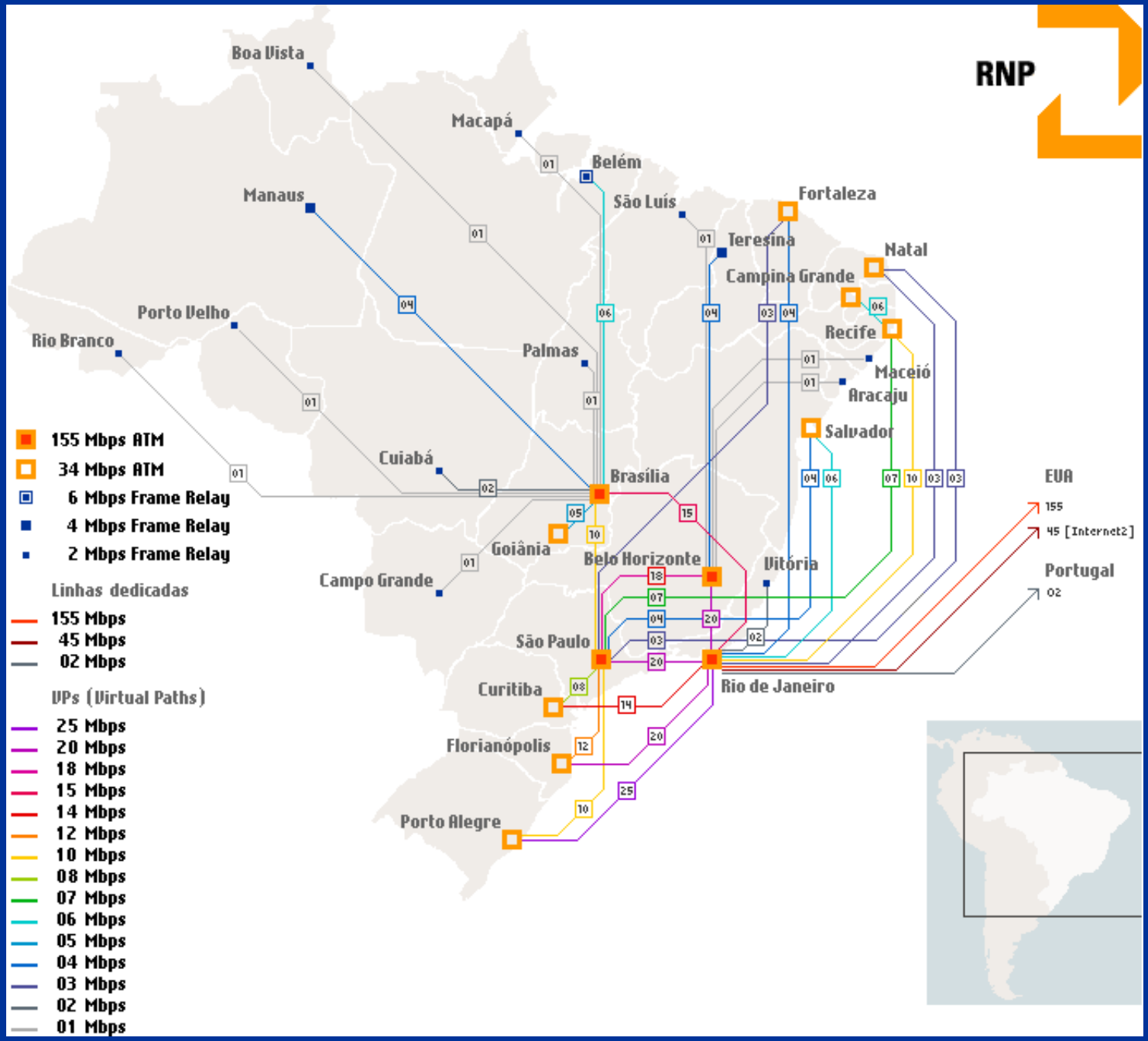
- Alberto Santoro
- phd and master students of GPPD
  - Adenauer Yamin Corrêa - UCPel and UFRGS
  - Luciano Cavalheiro da Silva - UFRGS
  - Patrícia Kayser Vargas - La Salle, UFRJ and UFRGS
  - Marko Petek - UFRGS
  - Diana Adamatti - UFRGS
  - Iara Augustin - UFSM and UFRGS
  - Jorge Barbosa - UCPel and UFRGS

Contents

- Brazilian Network
- Brazilian Grid group
- Brazilian Grid Projects
- GPPD projects
  - DOAP: Grid middleware
    - adaptive scheduling
  - PRIMOS: high performance Java
  - VIC ++: adaptable VIC for Access Grid
- Final remarks

Brazilian Network Status

- Brazil - USA
  - 155 Mbps
  - Ampath (Miami), Internet 2: 45 Mbps
  - no link to Europe
- RS - SP/RJ: 45 Mbps
- UERJ - CBPF: 8 Mbps
- CBPF - RNP: 100 Mbps (local)
- SP - RJ: 10 Mbs
- RS: 1 - 2 Mbps



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Brazilian Network Expansion

- Submitted project to Funttel
  - Gigabit network - GbE/WDM
  - Unicamp, CPqD/RNP, USP, INPE, LNCC, UFRJ, PUC-RJ, UFF
  - 2002-2003

Brazilian Grid Group

- First national meeting
  - organized by CNPq by October 2001

  Participants:
  - CNPq, Finep
  - RNP: research national network
  - members of CENAPADs, LNCC
  - application users (HEP, universities, Petrobras)
  - researchers on high-performance computing

Brazilian Grid Group

- Goals
  - promote the use of Grid
- 3 working groups
  - hw infrastructure
    - network, systems (clusters), ...
  - sw organization
    - middleware, accounting, security, ...
  - applications

Brazilian Grid Group

- Some initial propositions, documents
  - first meeting report
  - proposition for sw organization
  - proposition for applications
  - some discussions on important points
- A Grid email list
- http://www.inf.ufrgs.br/procpar/hetnos/grid/papers/

Globus Experience

- Globus installation
  - Myrinet/PC cluster of II-UFRGS
  - second semester of 2001
  - next steps
    - use with some academic applications - tests
    - evaluate the possibility of integration between our projects and Globus

VRVS Experience

- Reflectors
  - RNP, UERJ, UFRGS
- GRID Workshop at UERJ
  - Conferences with Fermilab, CERN, brazilian groups
- Microelectronics Millenium Institute

Brazilian Grid Projects

- An overview of main Brazilian initiatives
  - HEP
  - MultiCluster
  - GridGene
  - IC Grid
  - MyGrid
  - Millenium Institute SCMN
  - National Grid
- Probably it is not a complete list

HEP

- Current state
  - UERJ (A. Santoro)
    - a grant from Faperj
    - February 2002
    - a cluster with (perhaps) 32 nodes
  - UFRGS
    - has two small clusters
      - Myrinet, fastethernet, SCI
    - bulding a new 32 nodes Myrinet cluster
    - mainly for development and testing

Brazilian Grid Projects - 1

- MultiCluster
  - II/UFRGS
  - contact: Prof. Philippe O.A. Navaux
- It aims to efficiently integrate different cluster-based architectures
  - Myrinet, SCI, Fast Ethernet, ...

http://www-gppd.inf.ufrgs.br/projects/mcluster/

Brazilian Grid Projects - 2

- GridGene
  - UFRJ, LNCC/MCT, UFPB/Campina Grande
  - contact: Prof. Paulo Bisch
- It aims to support
  - genome analysis
  - through development of parallel and distributed software for Grid environments
- http://www.inf.ufrgs.br/procpar/hetnos/grid/papers/gridgene.pdf

Brazilian Grid Projects - 3

- IC Grid
  - UFF
  - contact: Prof. Vinod Rebello
- Creation of a mini-grid testbed
- Design and development of grid-base middleware
- http://www.ic.uff.br/~vefr/research/cluster.html

Brazilian Grid Projects - 4

- MyGrid
  - UFPB
  - contact: Prof. Walfredo Cirne
- It provides a global execution environment
- It is distributed as a free software
- http://lula.dsc.ufpb.br/~walfredo/projetos/OpenGrid/

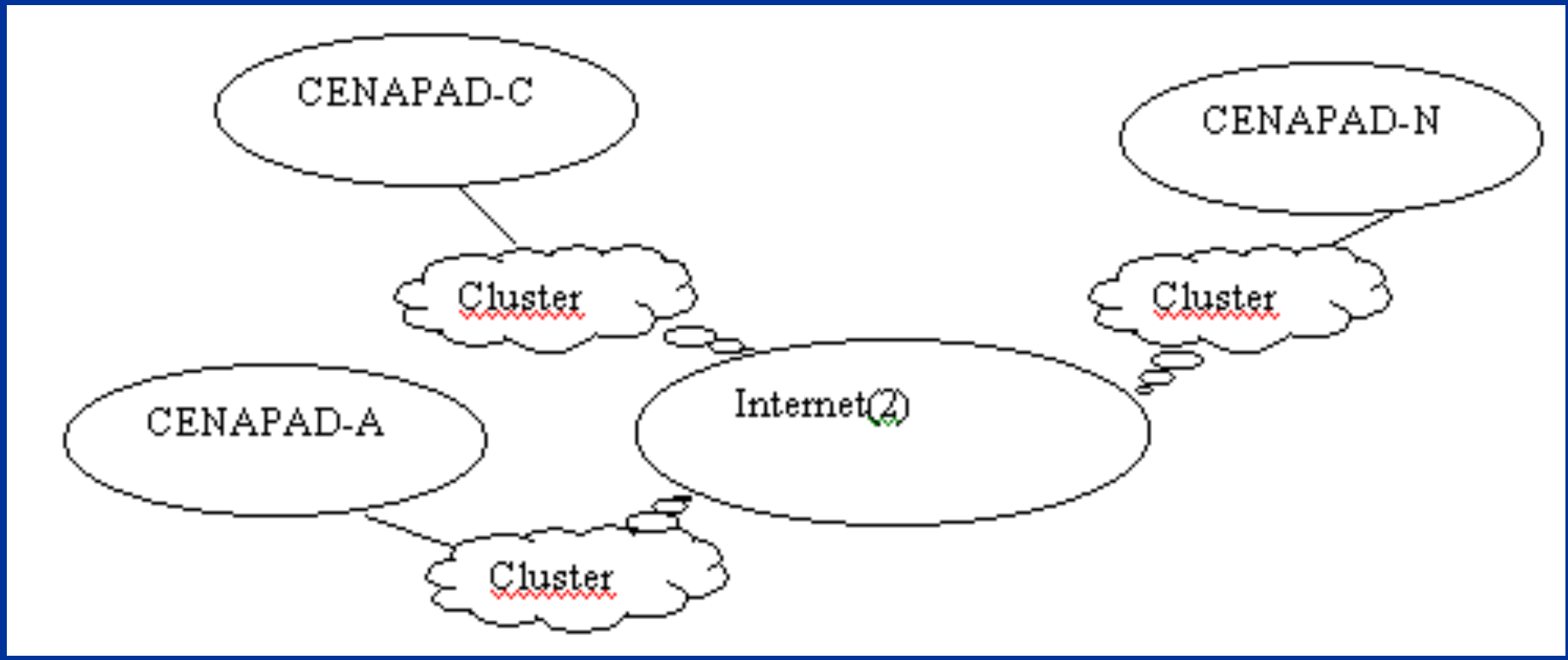
Brazilian Grid Projects - 5

- Millenium Institute Research Network on Chip, Microsystems and Nanoelectronics - Rede Pesquisa em Sistema em Chip, Microssistemas e Nanoeletrônica - SCMN
- videoconference, classes, IC design
- UFPE, UFRJ, UNB, USP, UNICAMP, UFCS, UFRGS
  - contact: Prof. Jacobus W. Swart
- http://www.ccs.unicamp.br/scmn

Brazilian Grid Projects - 6

- Proposal: build a national Grid of Cenapads
- Cenapad
  - HPC national (federal) center
  - offers HPC resources to application users
  - nowadays there are:
    - six CENAPADs (HPC centers)
    - a SINAPAD (integration of these centers)

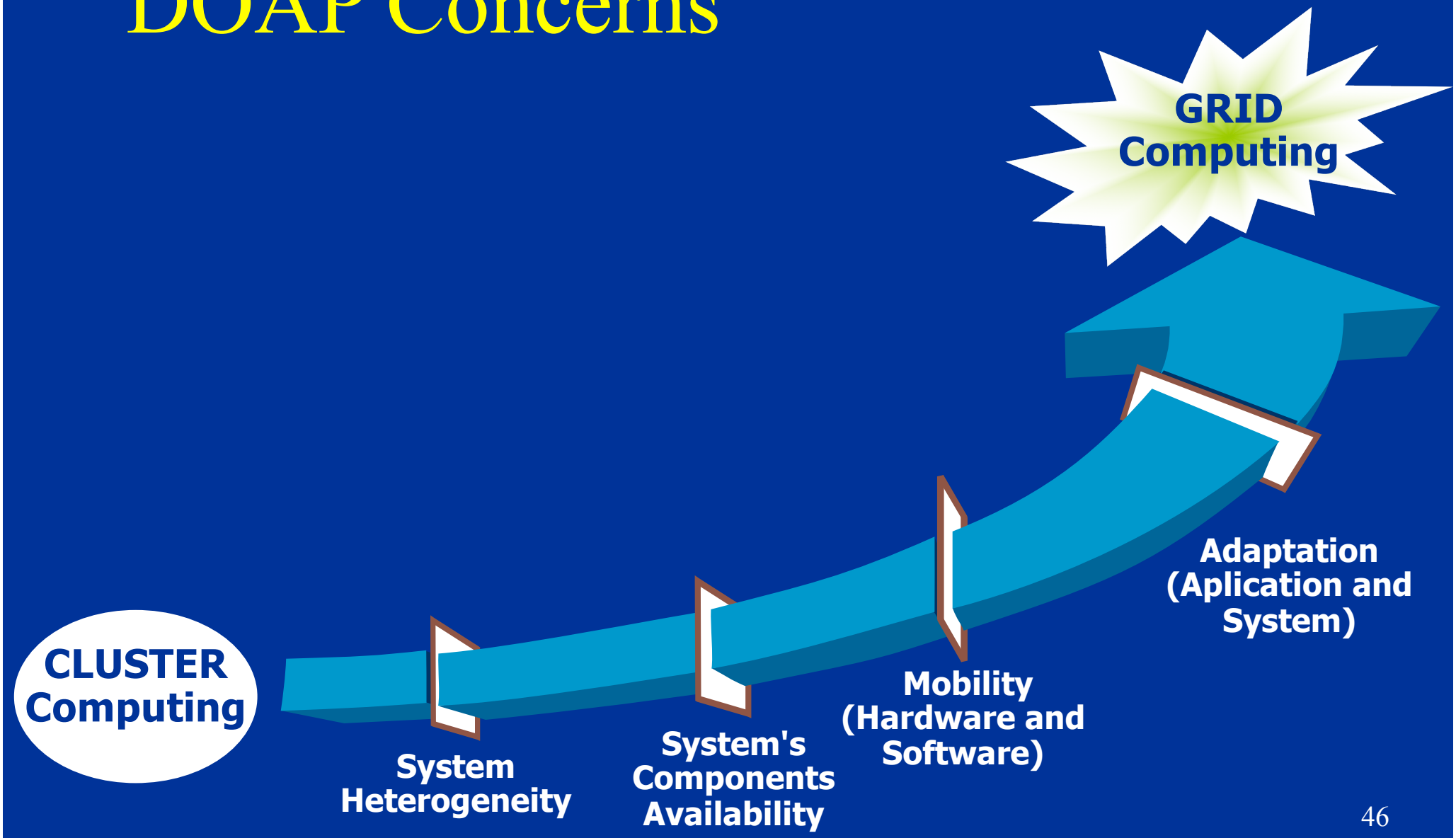
Brazil / Cenapad Grid



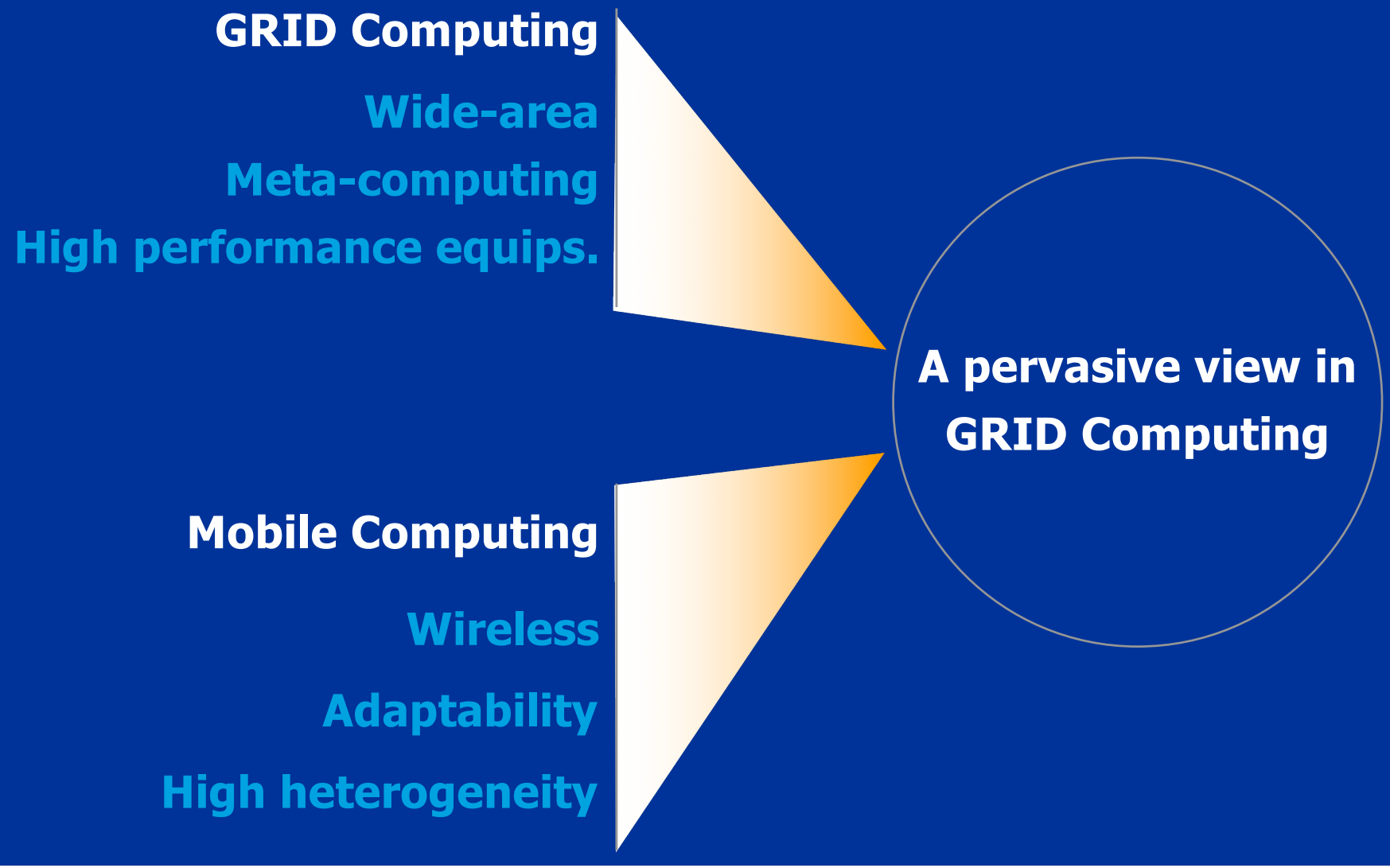
GPPD Projects - DOAP

- Grid-like middleware
- Distributed object oriented programming
- Adaptive scheduling
- Mobile computing

DOAP Concerns

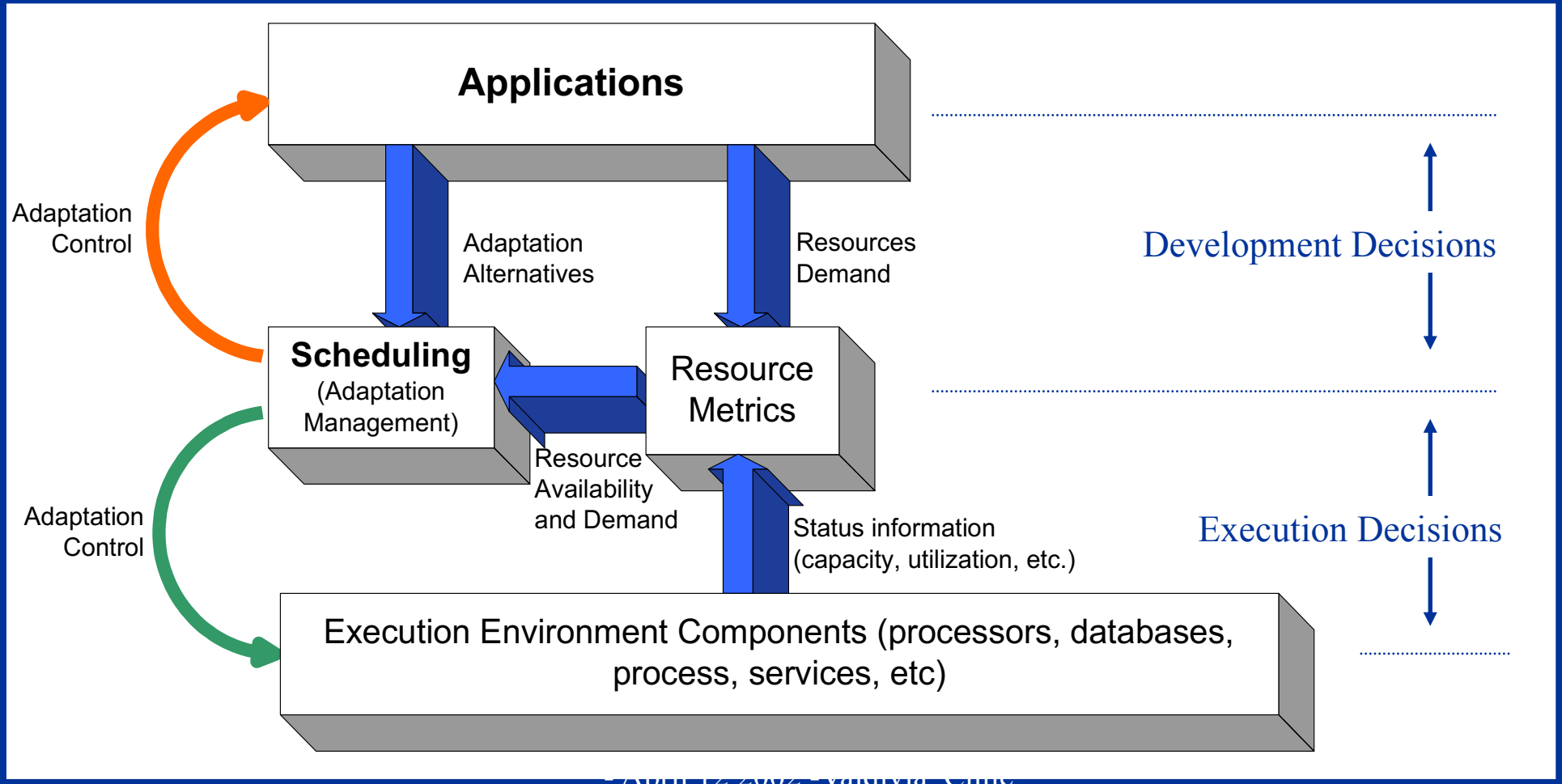


DOAP: a pervasive view

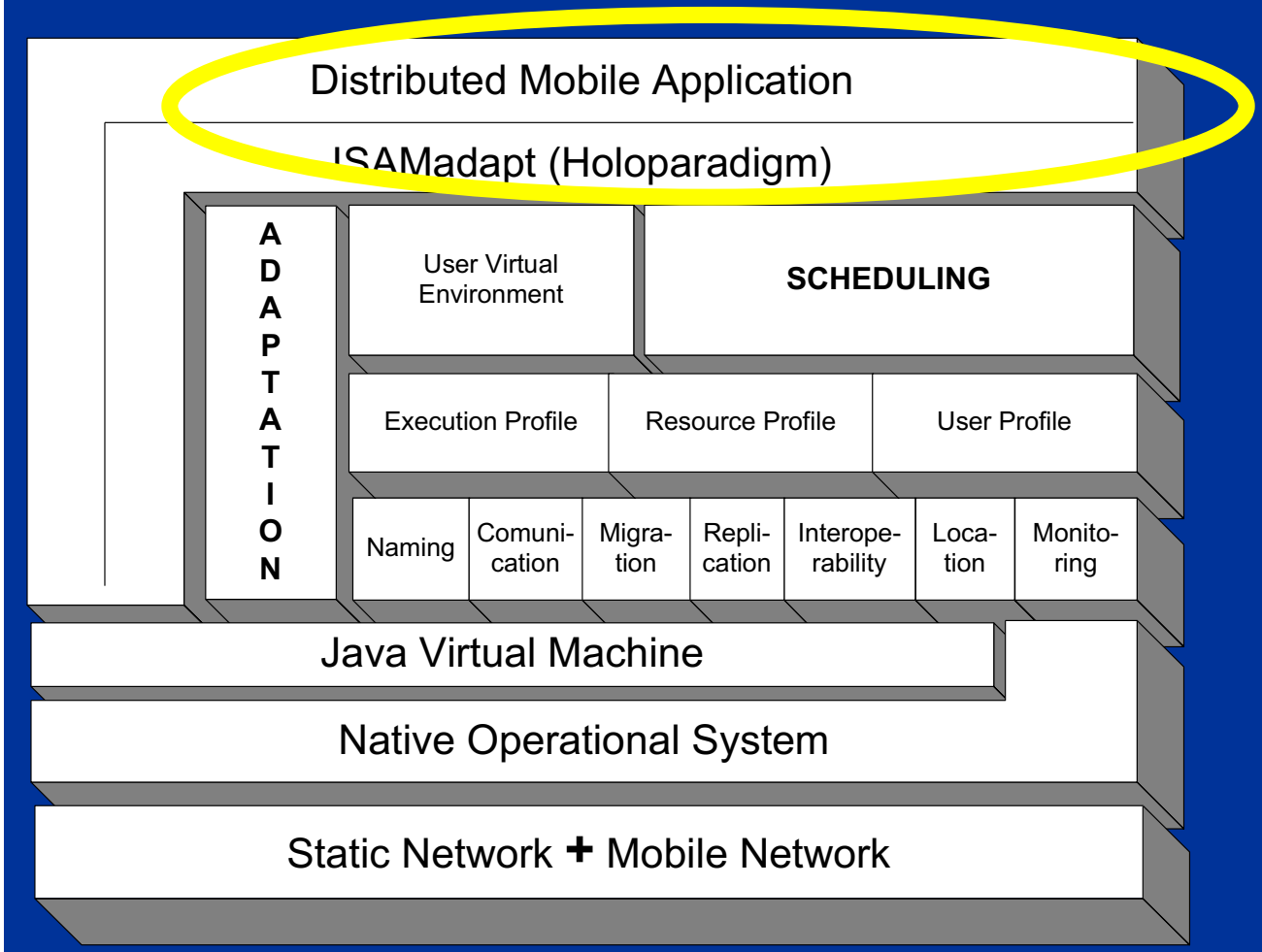


GRID Computing in DOAP

Adaptation Centric Scheduling



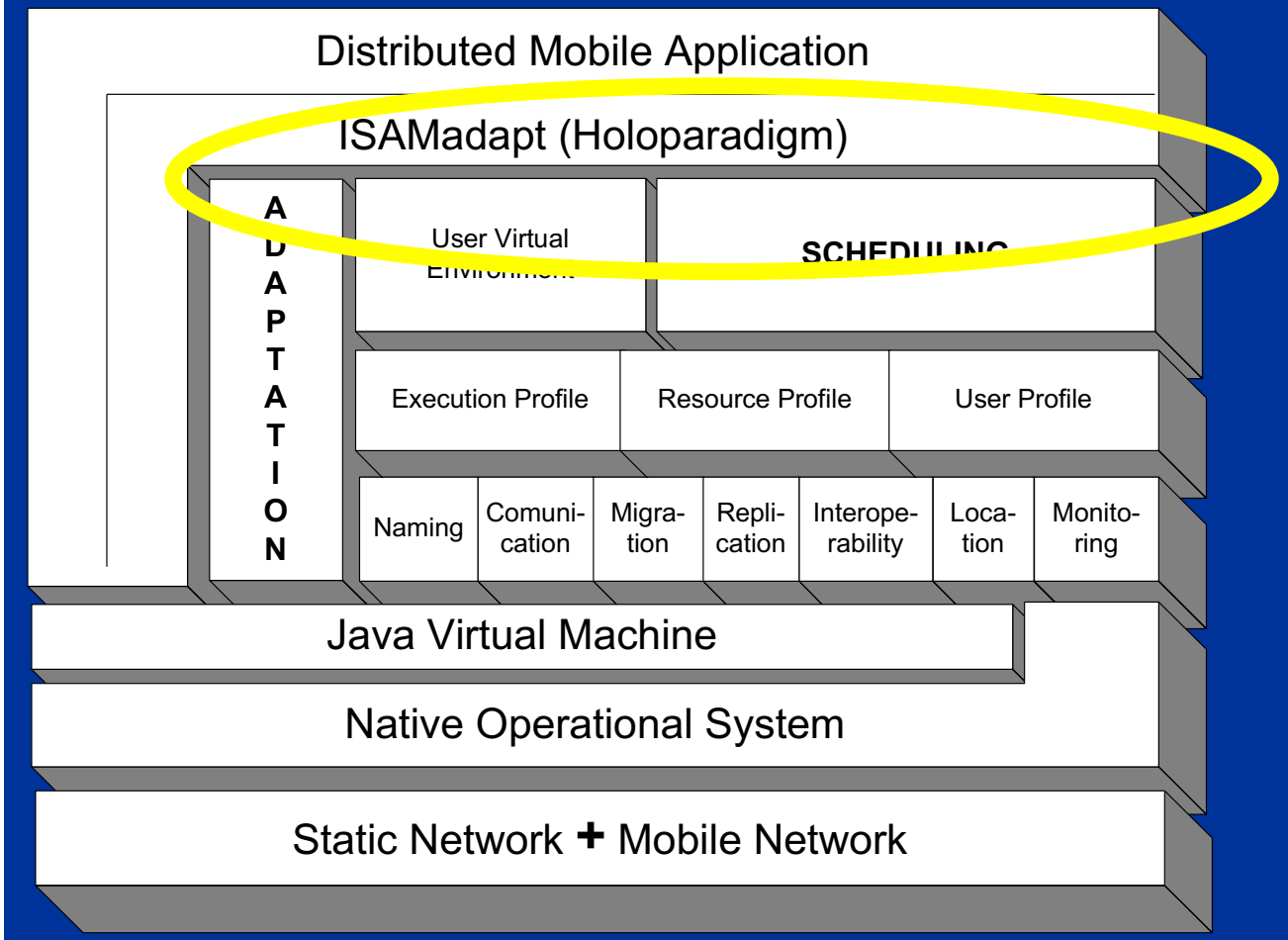
DOAP Architecture



Holoparadigm

Multiparadigm;
Blackboards;
Mobility.

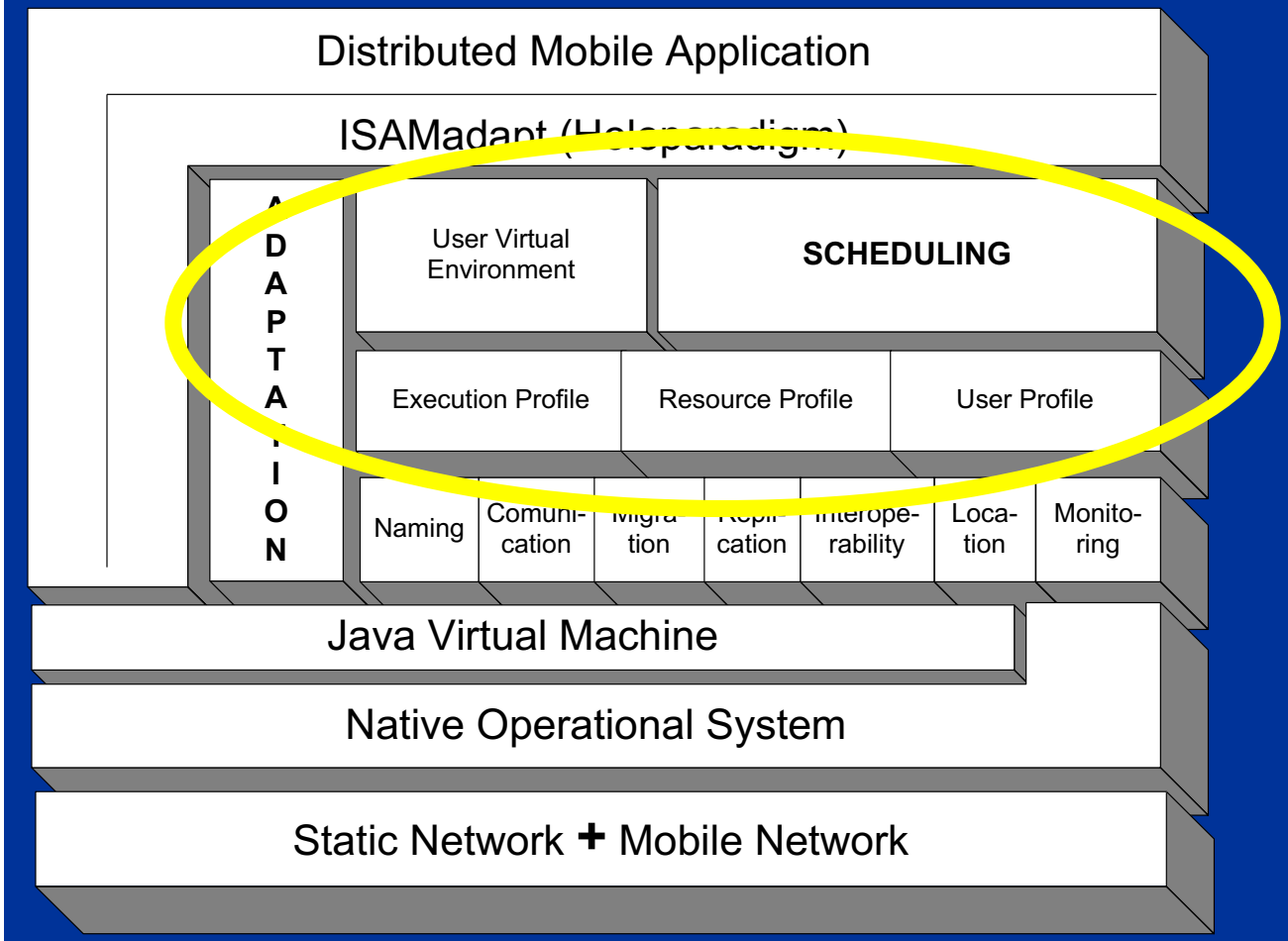
DOAP Architecture



Mobility:
- Hardware and Software

Language level adaptation constructors

DOAP Architecture

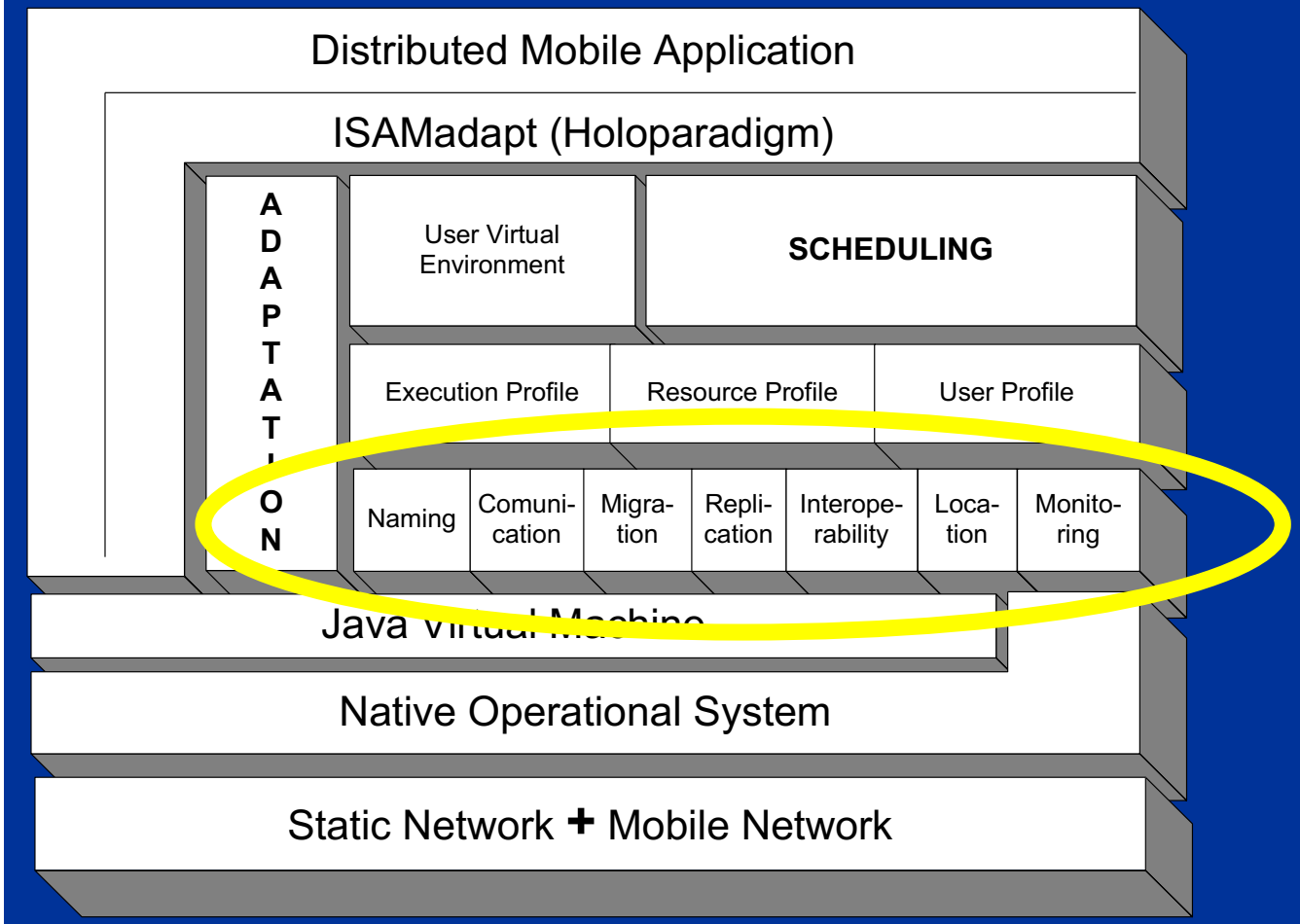


EXEHDA

High Distributed Applications

Execution level adaptation mechanisms

DOAP Architecture



Proposals for object:

Migration;
Optimized communication;
Monitoring

GPPD Project - VIC ++

- Access Grid
  - a Grid for people interacting by Grid resources
  - interaction between groups
  - distributed seminars, discussions, workshops, classes, ...

VIC++

- VIC and RAT
  - software for video and audio transmission
  - mbone tools
  - used by Access Grid (also VRVS)

VIC++

- Global Supercomputing 2001
  - a node at Instituto de Informática - UFRGS
- Experience results
  - mbone tools are not easy to operate
  - they lack some features for adaptation to dynamic environment

VIC ++

- VIC ++
  - an extension of VIC
  - two main targets:
    - an adaptive algorithm
      - adjust the VIC configurations to the network conditions
      - reduce the work of the operator during a session
  - to expand the statistics generator of the VIC
    - in order to provide more data to the researcher

VIC++

- Distributed XPDF
  - alternative to Distributed Power Point
    - used by AccessGrid
  - working
  - free software

Final Remarks

- Several projects on Grid software
  - adaptive scheduling
  - Java HP programming
  - Access Grid/Vic++
  - Multicluster
  - Global execution environment
  - Grid testbed for new Grid middleware

Final Remarks

- Two important Grid applications
  - HEP
  - Genome
- Brazilian Grid group
- Sinapad Grid
- Other projects are moving to Grid
  - Millenium Institute SCMN
  - mainly cluster (HPC) and distributed projects

End

A lot of work is necessary ...