Digital Divide Network Developments in Brazil & L.A. For HEP

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Outline

I   -Introduction
II   -T2-HEPGRID Brasil
III -RNP and Brasil News
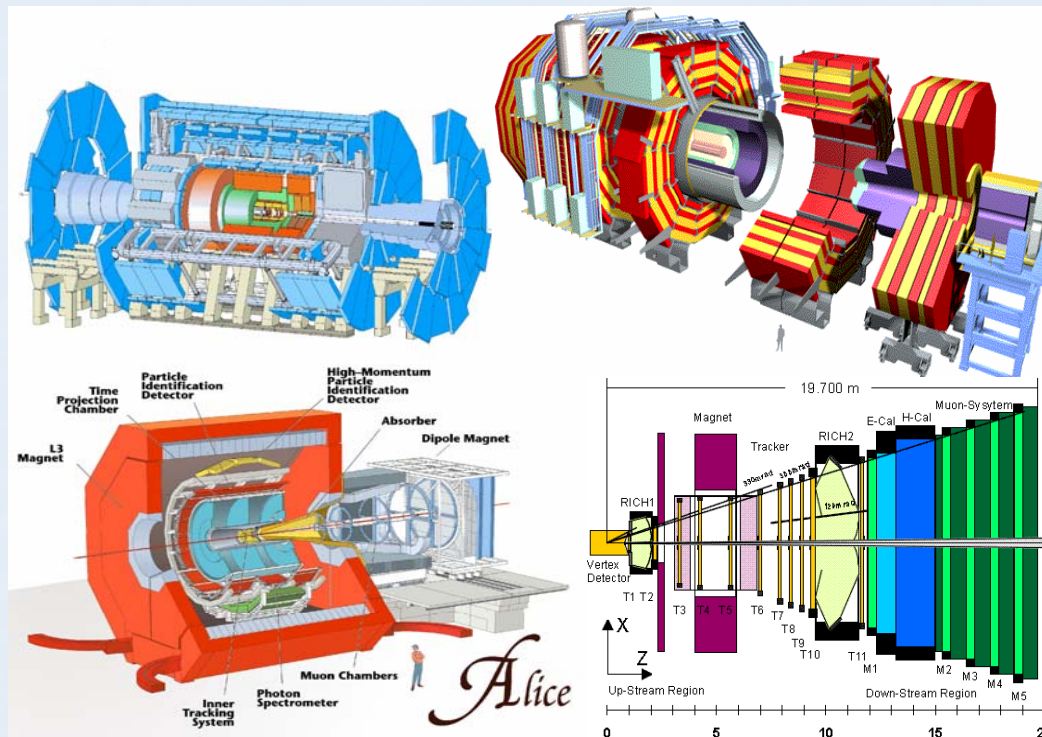**IV   -L.A. News**
V   -Conclusion

I -Introduction

- Network in Brazil has been one of the main concerns of the Brazilian governement.

- The recent support to the National Network by the Minister of Science and Technology demonstrate the way that we are solving the problems.

- RNP initiatives, GIGA, "RECOMED" –Metropolitan Network, and IPÊ –Innovation-Recherch-Education are main current projects.

- Perhaps, our Naive Formula to respond for what can we do? like in HEP: Collaborate and Cooperate! It was extended to the RECOMED project.

- Let us see a bit from a High Energy Physicist point of view.

I WILL BE NOT EXAUSTIVE ON BRAZILIAN INITIATIVES
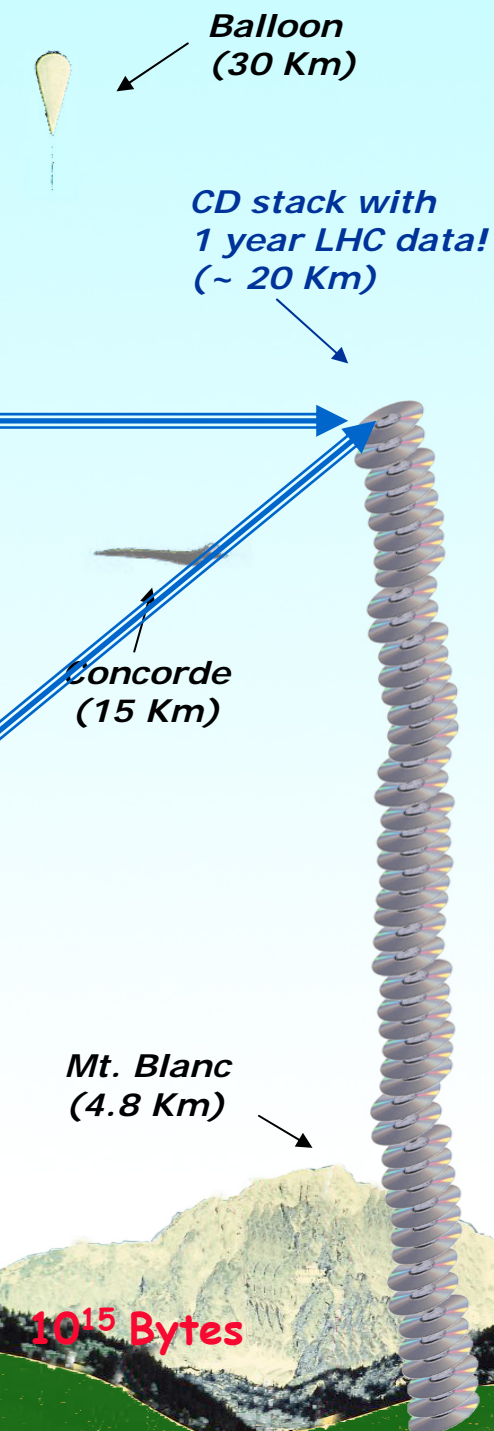
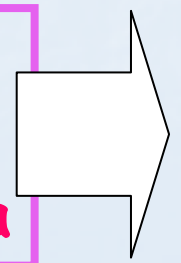**These four Detectors at LHC will Produce in one year:**

Motivation to build HEPGRID in Brazil

Balloon
(30 Km)

CD stack with
1 year LHC data!
(~ 20 Km)

(~ 20 Petabyte)

Concorde
(15 Km)

Mt. Blanc
(4.8 Km)

**How to Storage,
How to Analyse,
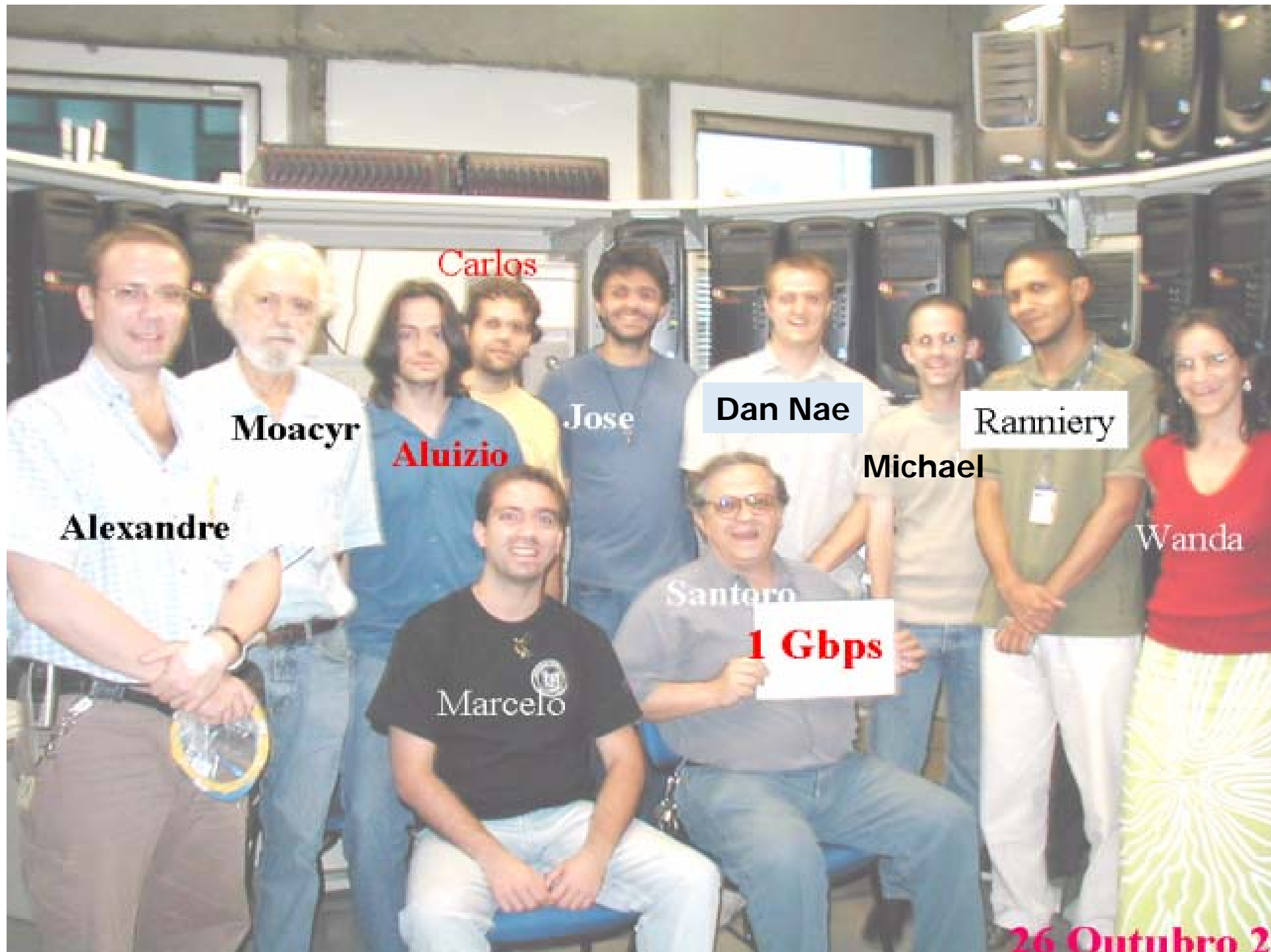How to organize these data**

GRID

10^{15} Bytes

1 Petabyte = 10^3 Terabytes = 10^6 Gigabytes = 10^9 Megabytes= 10^{12} Kilobytes= 10^{15} Bytes

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CMS Experiment
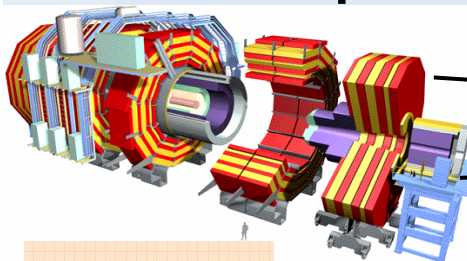
Online System

> ➢ **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

Tier 0

10 Gb/s

10+ Gb/s

Tier 1

Korea   UK   Russia   FNAL   •••

~10 Gb/s

Tier 2

DISUN

Caltech   UCSD   UFl   UERJ   •••

~10 Gb/s

Tier 3

UCLA   UCR   UCSB   USP
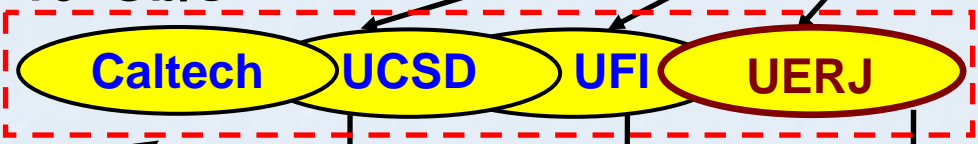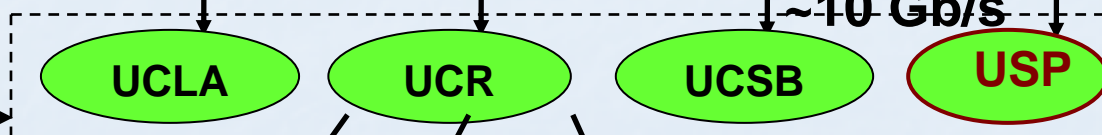
Tier 4

Physics caches   **PCs**

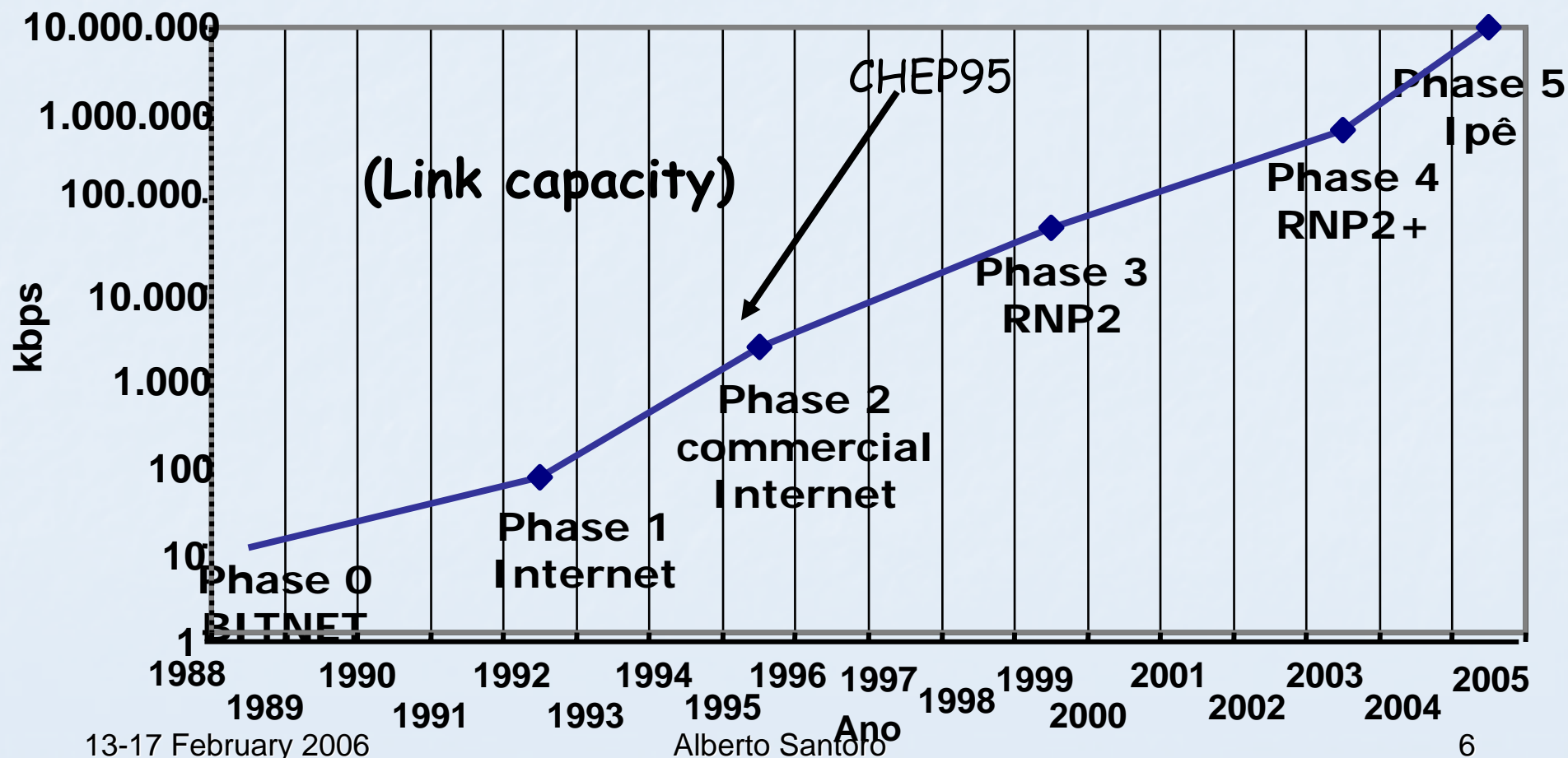## Evolution of academic networks in Brazil

Project GIGA – an optical networking testbed
IPÊ – RNP's Phase 5 national network (Innovation-Recherch-Education)
Redecomep – Community-based Optical Metropolitan Networks

CHEP95

(Link capacity)

Phase 5
Ipê

Phase 4
RNP2+

Phase 3
RNP2

Phase 2
commercial
Internet

Phase 1
Internet

Phase 0
BITNET

kbps

Ano

- **Introduced in 2004/5**
- **IP/SDH(replacing IP/ATM)**

- **first multi-provider network**
  - **until late 1990s telcos were state monopolies**

- **6x the aggregate capacity of the previous (ATM) network at 2/3cost**

(SDH=Synchronous Digital Hierarchy)

Fase 4 April/2005 (2 Gbps)

Conexões e circuitos
1° semestre 2005

- 622 Mbps (STM4)
- 155 Mbps (STM1)
- 34 Mbps (E3)
- 8 Mbps (E2)
- 4 Mbps (2xE1)
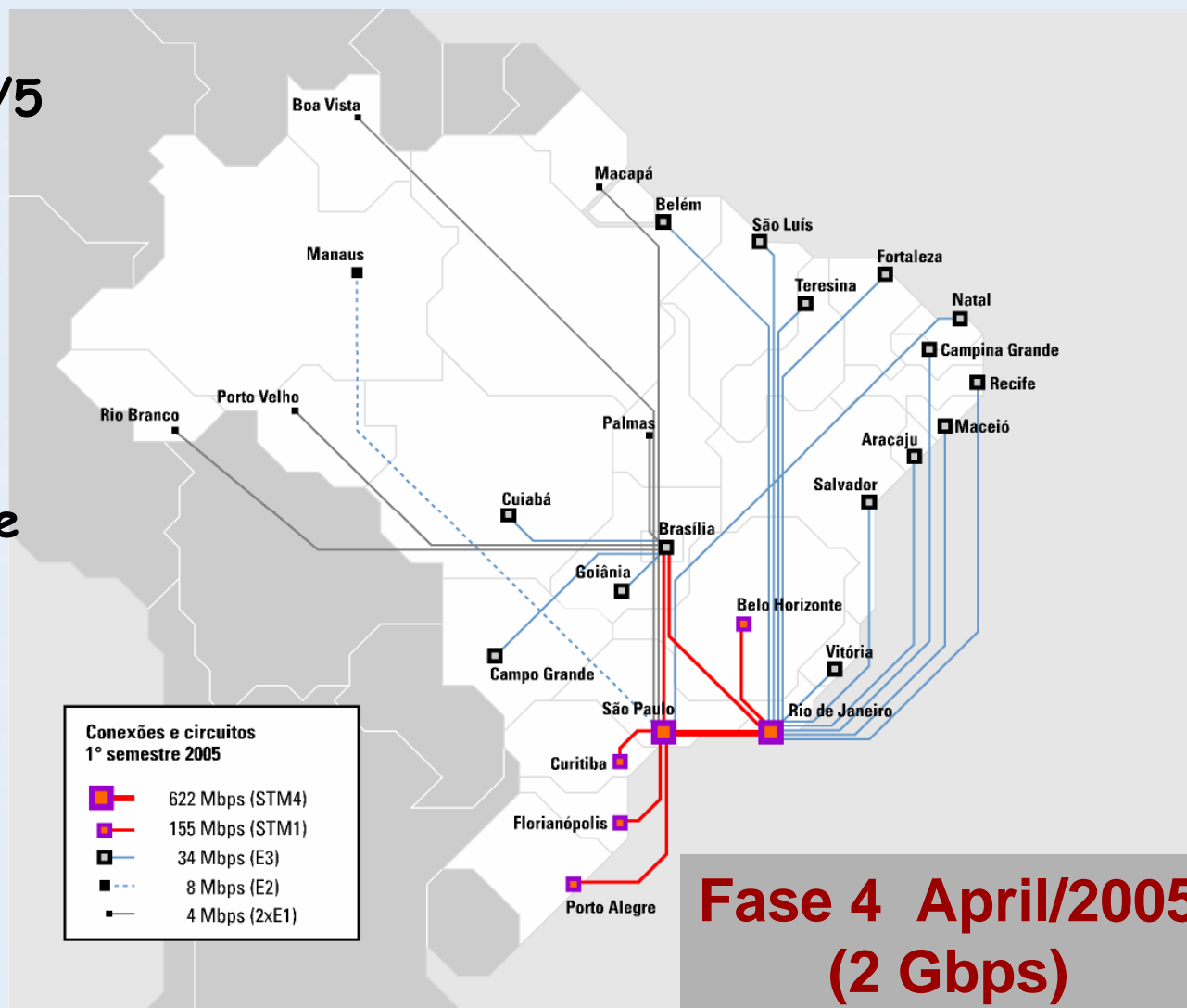
GIGA testbed network - location

Universities
IME
PUC-Rio
PUC-Campinas
UERJ
UFF
UFRJ
Mackenzie
UNICAMP
USP

R&D Centers
CBPF
CPqD
CPTEC
INCOR
CTA
FIOCRUZ
IMPA
INPE
LNCC
LNLS

1 : Campinas
2 : São Paulo
3 : S.José dos Campos
4 : Cachoeira Paulista
5 : Rio de Janeiro
6 : Niterói
7 : Petrópolis

ATLANTIC OCEAN

0   150   300   450   km
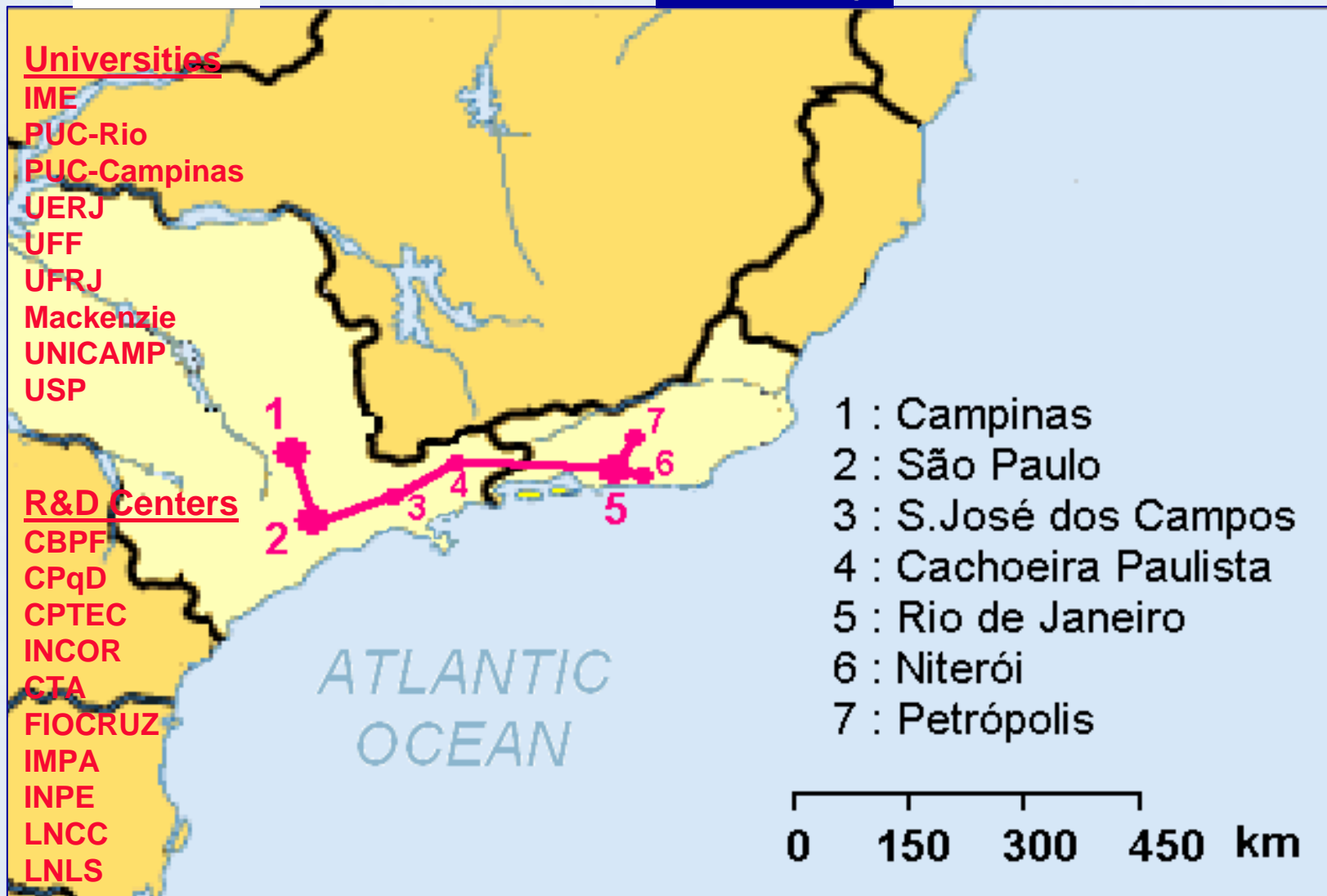
- **Multiple Gbps for interstate linksinitially between 10 cities**

- **unprotected 2.5 and 10G waves from 2 telcos**

- **only 3x cost of the previous SDH network for around 40x the aggregate capacity**

- **routers from Juniper Networks (M320, M40)**

2.5 Gbps
10 Gbps

Fortaleza
Recife
Salvador
Brasília
Belo Horizonte
Rio de Janeiro
Curitiba
São Paulo
Florianópolis
Porto Alegre
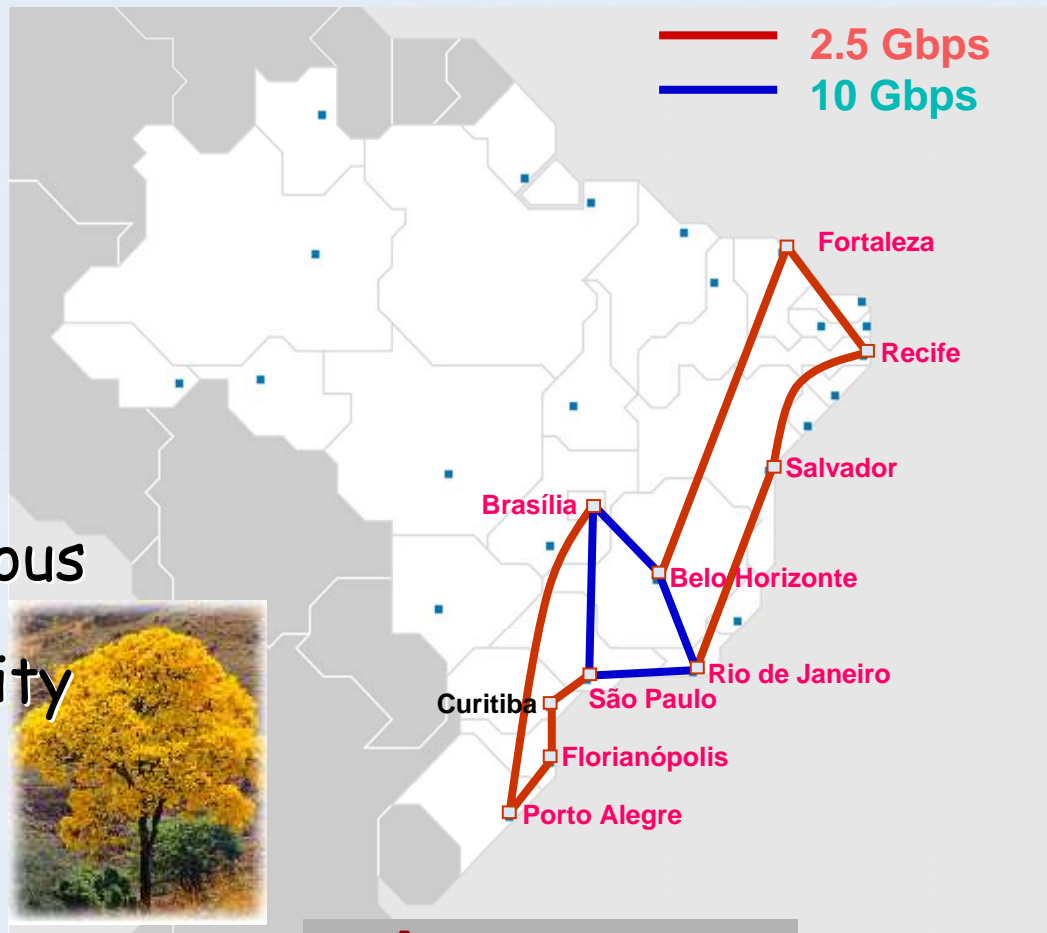
IPÊ – Nov 2005 (60 Gbps)

IPE = Innovation, Research, Education
SDH = Synchronous Digital Hierarchy

http://www.redecomep.rnp.br

REDECOMEP
Redes Comunitárias de Educação e Pesquis

Optical Metropolitan Networks for the R&E community

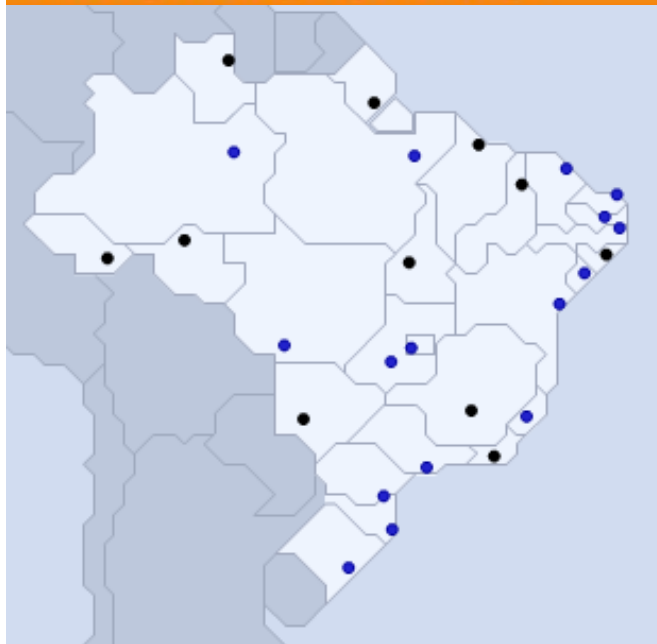| Página inicial | O que é | Downloads | Vídeos | Notícias | Na mídia | Contatos | Área restrita |

REDES METROPOLITANAS | **A INICIATIVA**

REDECOMEP is an iniciative of Ministery of Science and Tecnology (MCT) coordinate by RNP creating 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**
- **Investiment in own fiber until now.....R$13M ~ 6M$US**
- **coverage estimate....................................650 Km**
- **Investiment in equipment until now...R$10M ~ 4.5M$US**

Total > US$15 millions to be spent by December, 2006

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

1. Form a consortium for joint network provision
2. Build your own optical fiber network to reach <u>ALL</u> the campi of <u>ALL</u> consortium members
3. Light it up and go!

<u>Costs involved</u>:

- Building out the fiber: using utility poles of electric company
  - **US$ 8,000 per km**
  - **Monthly rental of US$1 (about 40 poles per km)**
- Equipment costs: mostly use cheap 2 port GigE switches
- Operation and maintenance

- Case study in 2004: Belém/Pará (eastern Amazonia): 12 <u>institutions using all GigE</u> connections:
  - Capital costs around US$500,000
  - Running costs around US$80,000 p.y.→This will be the cost p.y.
  - Compare with current US$240,000 p.y. for traditional telco
  - This is 3 TIMES MORE FOR 1000 LESS BANDWITHD
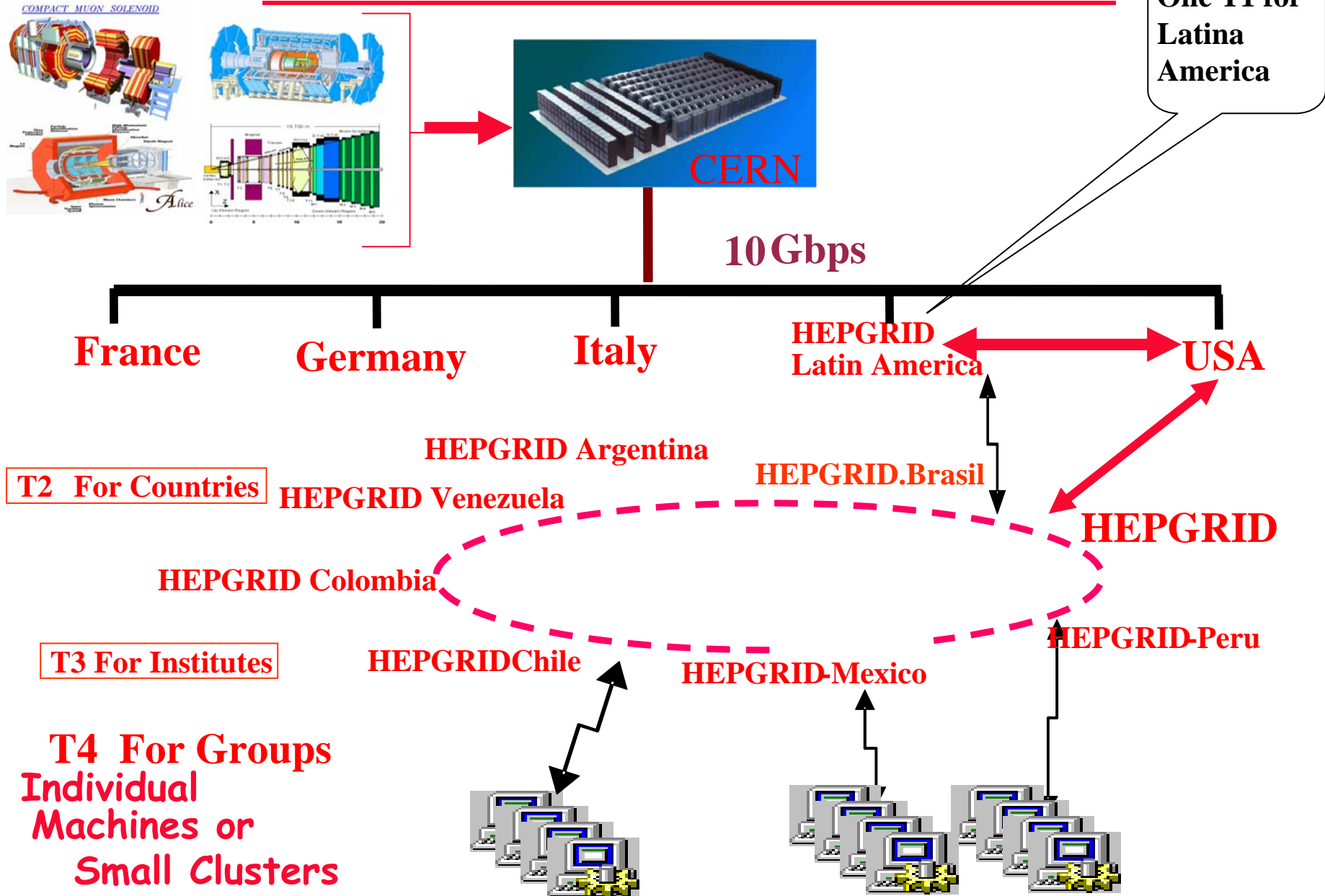
MANAUS-STATE NETWORK FOR
RESEARCH & EDUCATION OF AMAZONAS
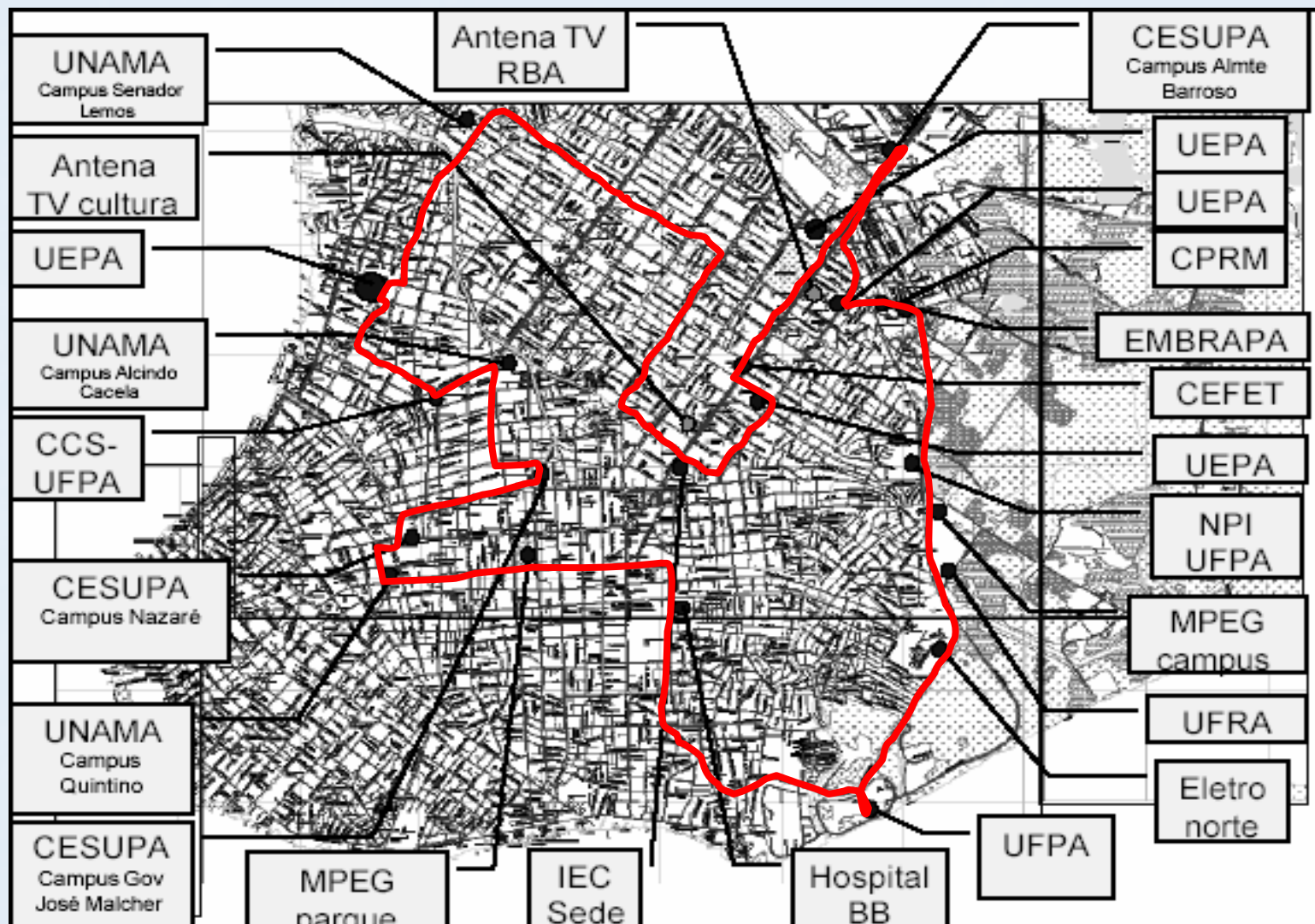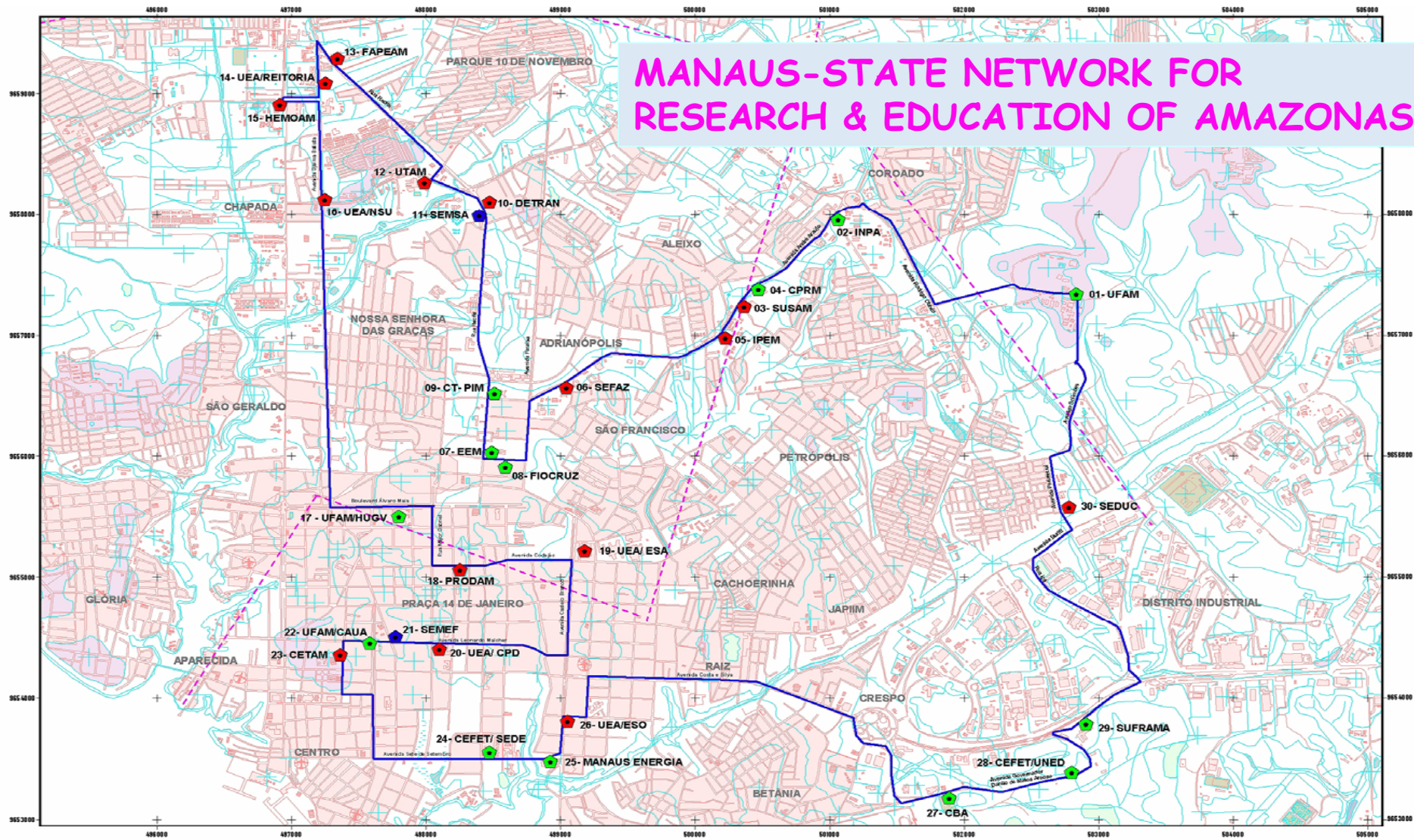
*By December 2006 more than 200 institutions with 1 Gbps
*connections Go to IPÊ backbone network (10Gbps)
*Last Mile connection will be pushed for DIY solution Connected to
  the Metropolitan Networks

Topology

GEANT

Tijuana / México

CU

HN
GT
SV   NI
CR
PN   Venezuela / Caracas

CU Cuba / Habana
HN Honduras / Tegucigalpa
GT Guatemala / Ciudad de Guatemala
SV El Salvador / San Salvador
NI Nicaragua / Managua
CR Costa Rica / San José
PN Panamá / Ciudad de Panamá

Colombia / Bogotá
Ecuador / Quito

Perú / Lima

Bolivia / La Paz

Sao Paulo / Brasil

Paraguay / Asunción

RED CLARA

Chile / Santiago

Uruguay / Montevideo
Argentina / Buenos Aires

Topologia Red Clara

V -Conclusion

- We made some progress in the last 3 years
- In my view, not enough to get the opportunities in science in general.

Magic Equation = **C2I2**

Cooperation + Collaboration + Internal Initiatives

Cooperation + Collaboration + Internal Initiatives

Cooperation + Collaboration + Internal Initiatives

Thank You!