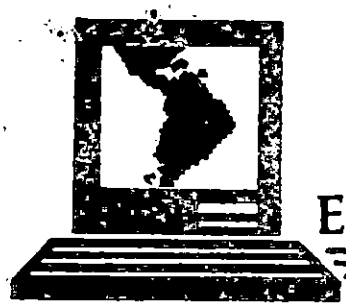

ESCUELA LATINOAMERICANA DE REDES

UNIVERSIDAD DE LOS ANDES
MERIDA - VENEZUELA
(2 AL 20 NOVIEMBRE, 1992)

NC7

EXPERIENCES IN BRAZIL FROM BITNET TO INTERNET

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Experiences in Brazil: from Bitnet to Internet

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Houston
New Orleans
Jacksonville
Tampa
GULF OF MEXICO
Miami
THE BAHAMAS
Nassau
Tropic of Cancer
Tampico
La Habana
CUBA
WEST INDIES
Veracruz
Mérida
Santiago de Cuba
HAITI
Port au Prince
Santo Domingo
PUERTO RICO (US)
Belmopan
BELIZE
Kingston
JAMAICA
Guadeloupe
Martinique
CARIBBEAN SEA
Guatemala
HONDURAS
NICARAGUA
Managua
CENTRAL AMERICA
Aruba
Curaçao (Neth.)
Barranquilla
Caracas
TRINIDAD & TOBAGO
San José
Panama Canal
COSTA RICA
PANAMA
Maracaibo
Georgetown
Paramaribo
Cayenne
Medellín
VENEZUELA
GUYANA
SURINAME
FR. GUIANA
I. del Coco (CR)
Buenaventura
I. de Malpelo (Col.)
Bogotá
COLOMBIA
Cali
São Pedro e São Paulo (Braz.)
Equator
Galápagos Is. (Ecu.)
Quito
ECUADOR
Guayaquil
Belém
Fortaleza
I. Fernando de Noronha
C. São Roque
Manaus
Amazonas
Talara
Pta. Aguja
Recife
Marcio
Trujillo
PERU
Salvador
BRAZIL
Callao
Lima
Cuzco
SOUTH AMERICA
Brasília
Arequipa
La Paz
BOLIVIA
Oruro
Arica
Sucre
Belo Horizonte
Trinidade
Iquique
Rio de Janeiro
Tropic of Capricorn
PARAGUAY
São Paulo
Asunción
Antofagasta
Santos
Curitiba
I. San Félix (Chi.)
San Miguel de Tucumán
Corrientes
Porto Alegre
Córdoba
Santa Fe
Viña del Mar
Valparaíso
Mt. Aconcagua
Mendoza
Rosario
Paysandú
URUGUAY
Islas Juan Fernández (Chi.)
Santiago
Buenos Aires
Montevideo
Concepción
ARGENTINA
Bahía Blanca
Mar del Plata
Valdivia
SOUTH ATLANTIC OCEAN
Punta Arenas
Falkland Is. (UK)
South Georgia (UK)
C. de Hornos
Drake Passage
SCOTIA SEA
South Shetland Is.
South Orkney Is. (UK)
GRAHAM LAND
Longitude West of Greenwich
1 : 40 000 000
The sea contour is drawn at 200 metres

Some Facts about Brazil

Size:	Fifth largest country in the world (8.5 M km2 - 5,000 km in diameter)
Position:	5 N to 35 S, 35 W to 73 W
Time zone:	GMT - 3 (i.e. mid-Atlantic)
Population:	160 millions
Largest cities:	Sao Paulo (14 M) Rio de Janeiro (9M).
Language:	Portuguese
Constitution:	Federal republic with directly elected president and governors,
Per capita GDP:	about US$ 2,500
Foreign debt:	about US$ 100 billions
Universities:	extensive federal system, complemented by some state systems (esp. S.Paulo), and private universities.

Telecommunications in Brazil

Presently a state (federal) monopoly, consisting of a long-range carrier (Embratel) and regional operators.

Embratel created a modern infrastructure in the 1970s, based on microwave links, but this is now being replaced by higher capacity radio links, and, by 1996, by optical fibre.

International service via (old) submarine cables and Intelsat, via optical fibre expected in 1996.

Subscriber dialling for interstate and international calls available since the 1970s.

Data commmunications

Leased lines (national and international) at 1200 to 9600 bps.

PSDN with national coverage with X.28 (1200 bps) and X.25 (2400 to 9600 bps) access. Linked to other national PSDNs.

Movement to 64 Kbps and higher speed services slowed by "last mile problem", since local operators use digital switching systems in many important cases: possible solutions are packet radio and digital service direct to clients. So far no "standard" solutions available (except VSAT).

Bitnet in Brazil

Since 1987, several independent initiatives led to requests to Embratel for installation of international circuits for connection to Bitnet. At the time Embratel did not permit the sharing of international circuits, necessary for setting up a national network. 3 circuits were delivered:

09/1988 Laboratorio Nacional de Computacao Cientifica (LNCC) in Rio de Janeiro, to University of Maryland, College Park.
(IBM to IBM: BSC-1, 9600 bps)

11/1988 Fundacao de Amparo a Pesquisa do Estado de Sao Paulo (FAPESP) in Sao Paulo, to Fermilab, Chicago.
(Vax to Vax: DECnet, 9600 bps)

05/1989 Universidade Federal do Rio de Janeiro (UFRJ) in Rio de Janeiro, to UCLA, Los Angeles.
(IBM to IBM: BSC-1, 4800 bps)

In October 1988, Embratel permitted (provisionally) the sharing of these channels for academic purposes, and the way was open to setting up a national network, and by 1990 national connectivity was essentially established, with the connection of most important centres either to Rio de Janeiro or Sao Paulo.

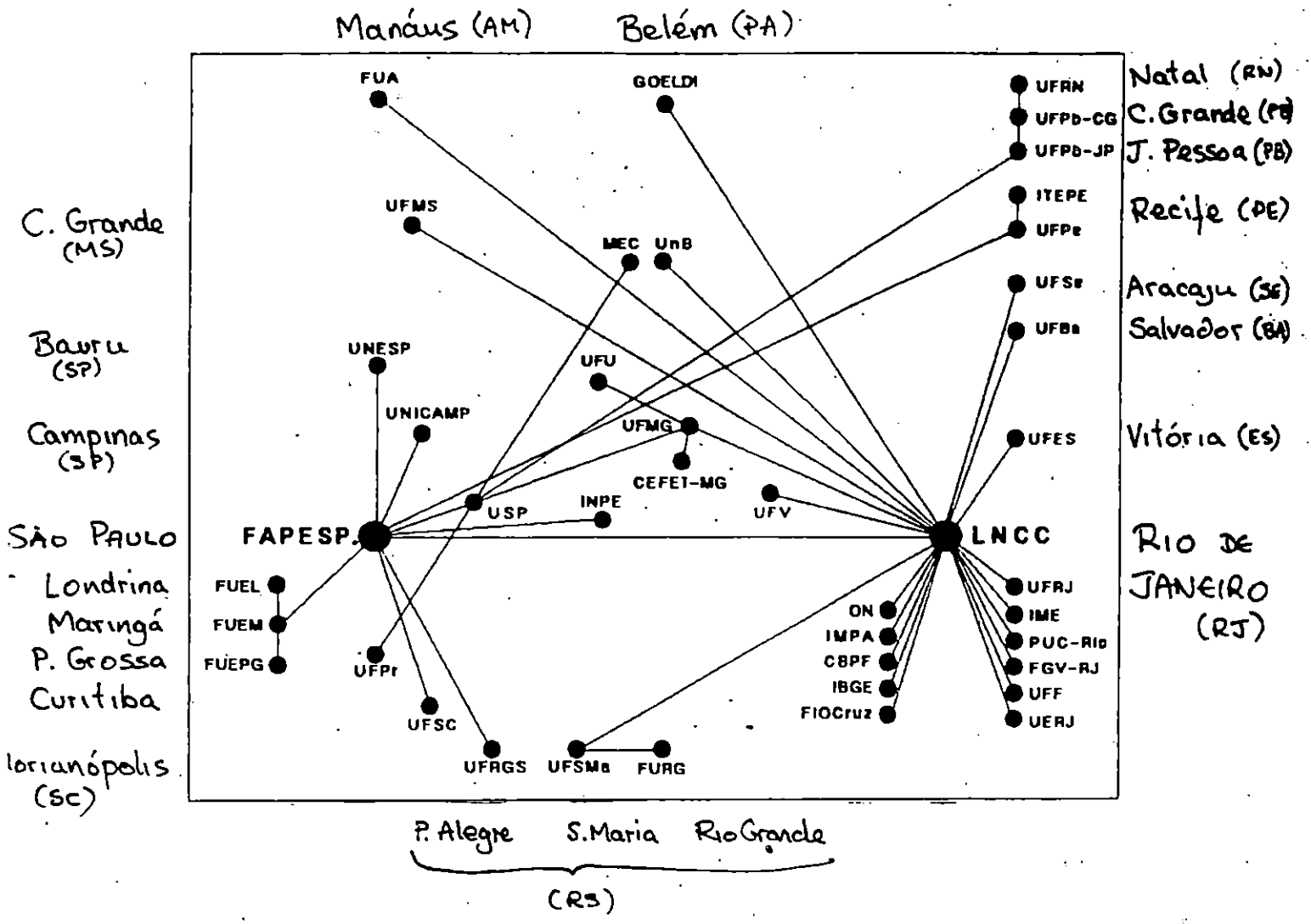
Bitnet - 2

The resulting network is composed mainly of IBM, Vax and Unisys mainframes, interconnected using standard Bitnet protocols. There is also a small segment of HEPnet (High Energy Physics Network) using DECnet between Vax machines.

Mailing services have also been extended, especially from FAPESP, by dial-up and PSDN connections, using UUCP and DEC products.

The result:

widespread access to e-mail.



MEC, UnB } Brasília (DF)

USP São Paulo (SP)

INPE S. José dos Campos (SP)

UFMG, CEFET-MG } Belo Horizonte (MG)

UFU Uberlândia (MG)

UFV Viçosa (MG)

SITUATION OF NATIONAL NETWORK IN DECEMBER 1991.

Experimentation with Internet

The creation of an e-mail network was necessary, but not sufficient for many researchers, who desired interactive access or extensive file transfer facilities. In early 1990, the election of a new government permitted the utilization of non-OSI standards, and, in particular, of TCP/IP.

This coincided with the growth of TCP/IP based LANs in university laboratories connecting Unix machines, and there is NOTHING more natural than TCP/IP to interconnect IP based LANs.

In February 1991, FAPESP installed TGV Multinet on their international gateway machine, and offered Internet access to those who could use it (initially LNCC and 3 universities). This (very) precarious network was improvised out of existing leased lines, using SLIP or IP/X.25 for connection. The extent of this internet has since grown to include two more universities and three institutes by early 1992, but the original international channel from FAPESP-Fermilab still only runs at 9600 bps.

Even with such performance limitations, this service is providing a useful service to a large (and rapidly growing) number of researchers, who would otherwise have to have mainframe accounts for network services.

A second generation academic network

The network in existence at the end of 1991 was eminently cooperative in nature, with each institution paying the telecommunications costs to connect, usually to Rio or Sao Paulo, i.e. a double star topology. A definitive solution should probably prefer a mesh topology, which would bring greater robustness, and probably diminish telecommuncations costs, by the greater use of shorter links.

To organize this requires some administrative structure, and a number of government agencies were convinced to spend money on providing network infrastructure.

National: the national council for scientific and technological development (CNPq) created the National Research Network (RNP) project, with the express aims of

- a: providing interconnectivity between state or regional networks,
- b: providing international access.

Regional: state governments were encouraged to provide regional infrastructure. (Many of these initiatives were encouraged by CNPq.)

Architecture of the new network (1992)

Inspired by the 3 level hierarchy adopted in the USA by the National Science Foundation (NSF), a similar model was adopted:

1. national
2. regional
3. institutional

A strictly hierarchical approach meant that institutional networks would connect only to regionals, and that the national network would only interconnect regionals.

The network technology would have to support a variety of protocol suites, in order to cater for existing and future alternatives, in particular, DECnet and CLNS (OSI), as well as TCP/IP. As a consequence, the national and regional networks should use multiprotocol routers, in order to extend the different alternatives to the institutional users. This permits the establishment of multiple logical networks on the same physical network.

As soon as feasible, line speeds should be increased to at least 64 Kbps on major links, especially the international ones.

Implementation

In the first semestre of 1992, the following new network components are due to be installed:

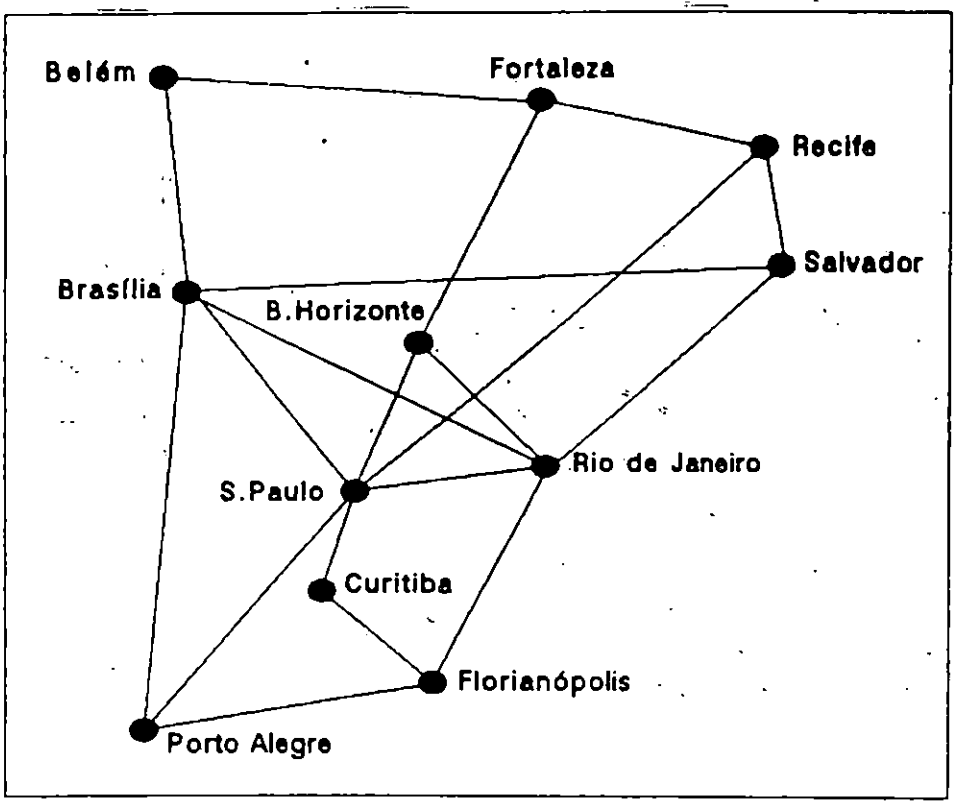
RNP: consisting of a national backbone network of 11 nodes, or "points of presence (POPs)", for attachment of regional networks. The topology is multiply connected, and the line speeds vary between 9.6 and 64 Kbps. Due to a funding delay, the routers initially will be Sun workstations, but these will be replaced as soon as possible.

RedeRio: Rio de Janeiro state network, linking institutions mainly localized in the city of Rio de Janeiro (former federal capital). Mostly uses 64 Kbps over urban PCM channels, and Cisco routers.

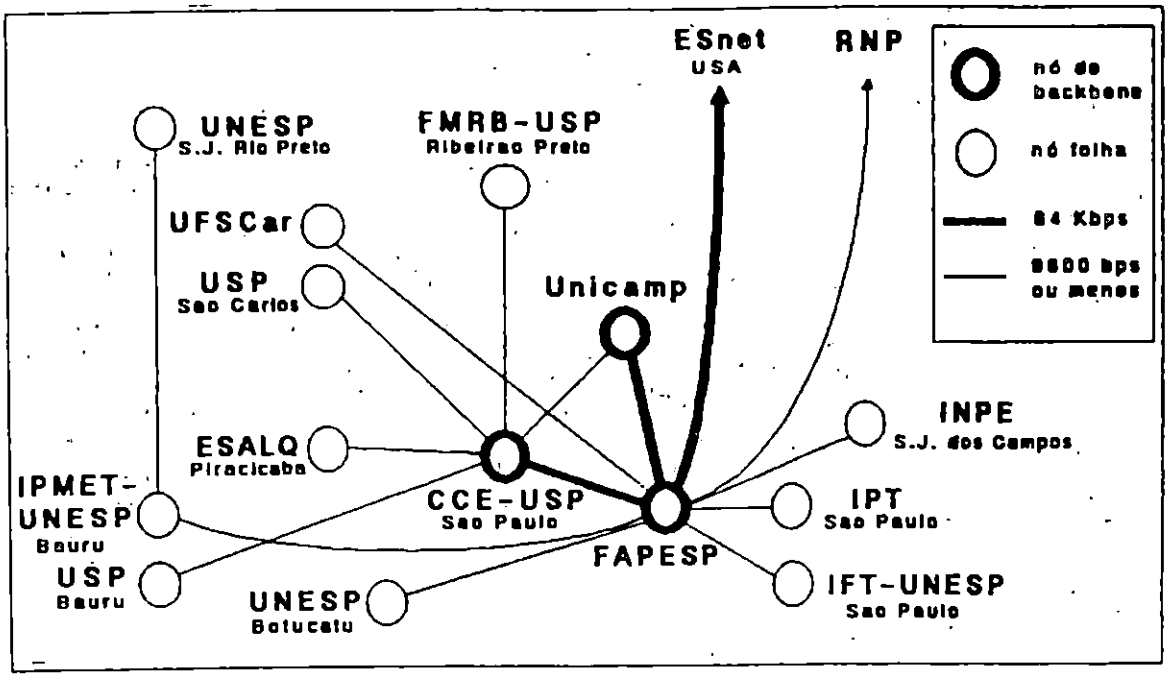
ANSP: Sao Paulo state network, confined to this state. 64 Kbps between the larger institutions, otherwise 9600 bps. Cisco routers.

International access will initially be provided by new 64 Kbps circuits:

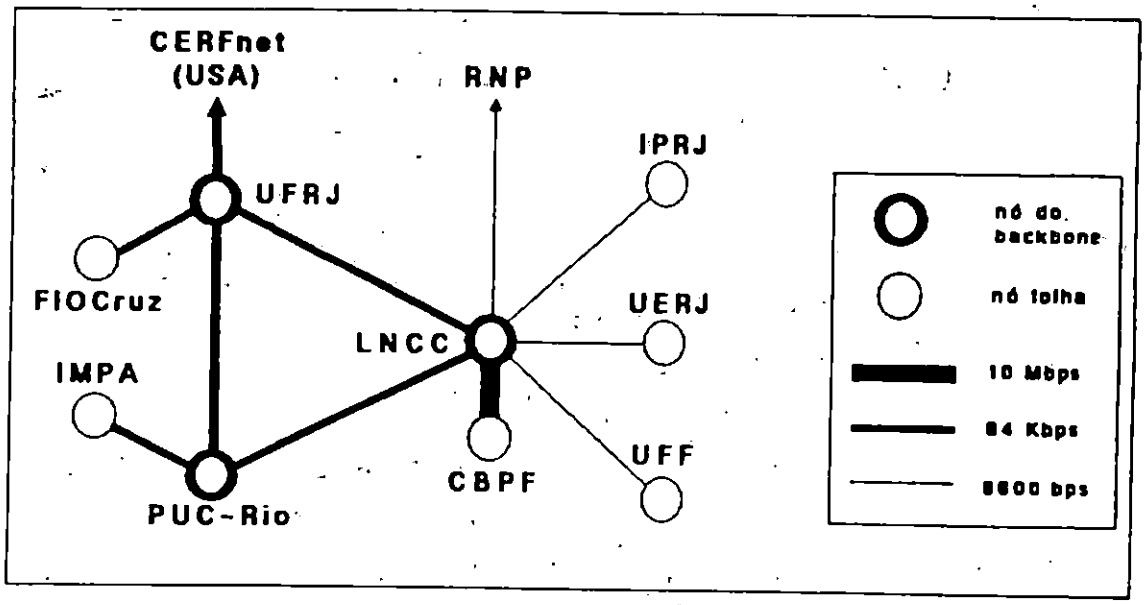
ANSP	to	ESnet (Fermilab)
RedeRio	to	CERFnet (San Diego)



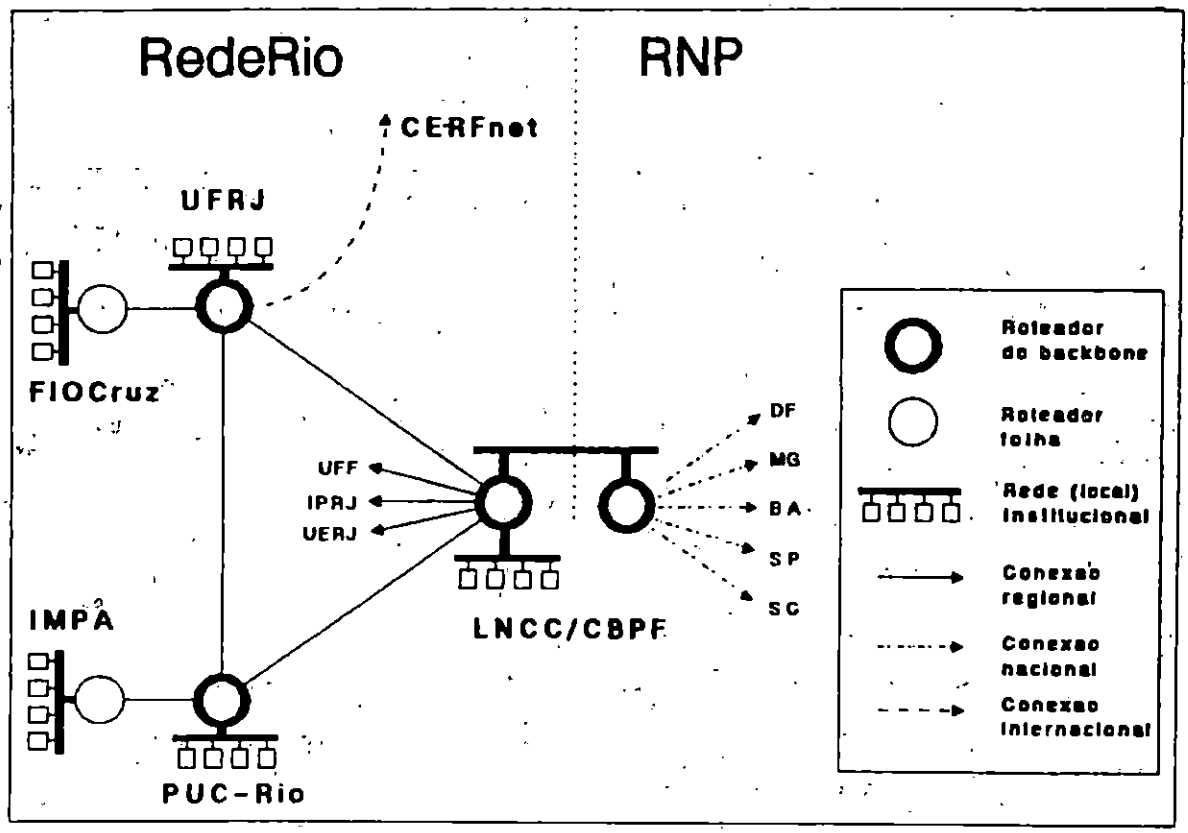
RNP: NATIONAL BACKBONE NETWORK (1992)



SÃO PAULO STATE NETWORK (1992)
(ANSP)



RIO DE JANEIRO STATE NETWORK (1992)
(REDERIO)



INTERFACES BETWEEN REDERIO, RNP AND INSTITUTIONAL NETWORKS.

Administrative: TCP/IP and other complex networks require centralized administration and management. This includes dealing with telecom companies and running Operations and Information Centres.

Financial: In cooperative networks, everyone pays their own bills. In a complex network, there is a need to share centralized costs, which is not always administratively or legally a simple matter.

Technical: Not all computers support TCP/IP protocols as naturally as Unix, or as cheaply as MS-DOS. Sometimes expensive software and/or hardware has to be acquired. The most common cases are Vax-VMS systems and IBM mainframes. Some solutions include:

VMS: TGV Multinet
IBM: TCP/IP for VM (or MVS)
(there are 2 connection choices:
LAN via IBM 3172 or equivalent,
or IP/X.25 using a serial line)

Future developments in Brazil

1. stabilization of the new networking infrastructure, and its propagation into non-central regions,

2. extension of networking connectivity into secondary education, and other research areas not currently network users,

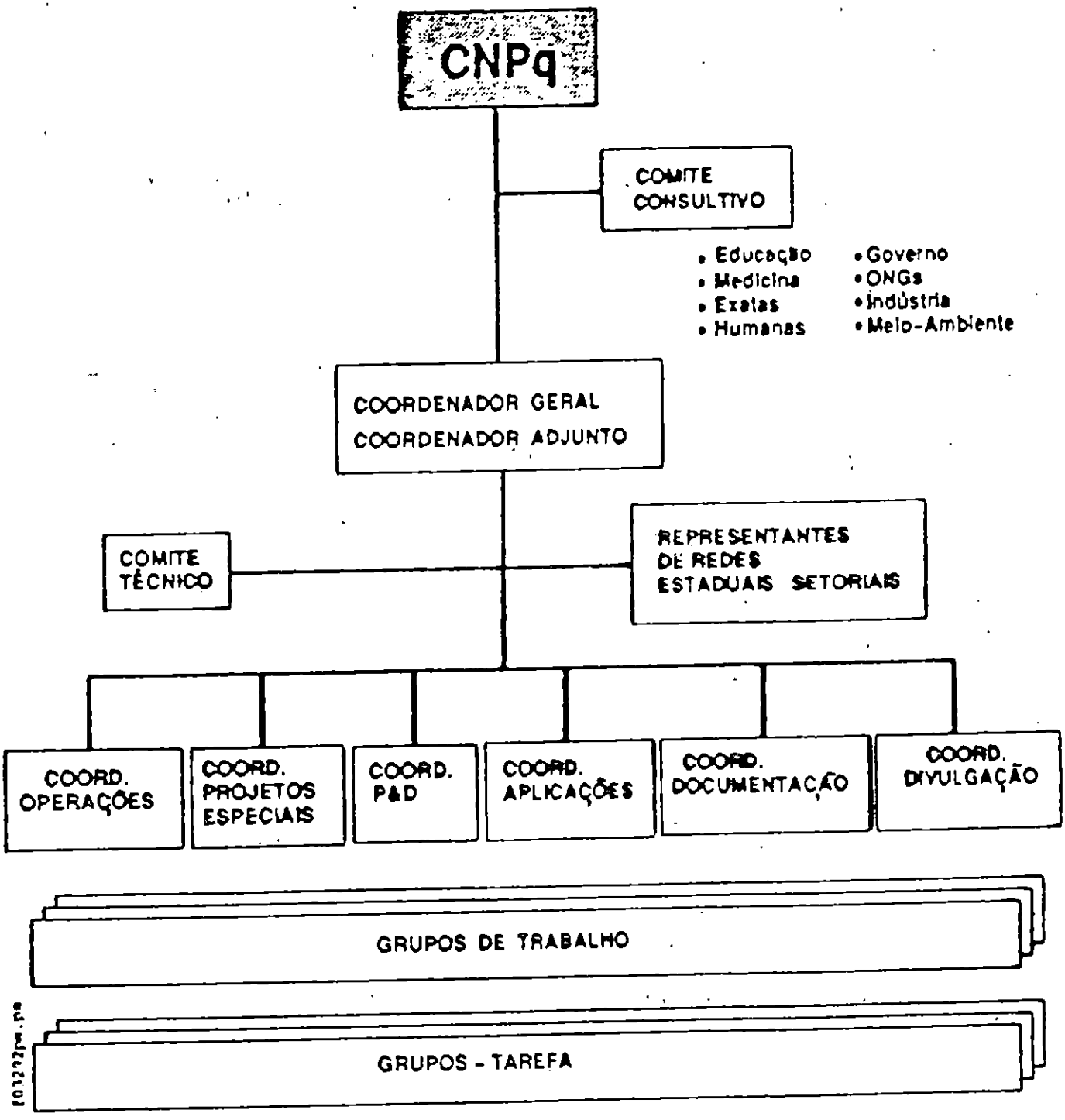
3. provide network access to existing automated data repositories, especially libraries,

4. investigate technologies for communicating with isolated and rural areas,

5. provide training on a huge scale.

REDE NACIONAL DE PESQUISA

ESTRUTURA ORGANIZACIONAL



NATUREZA DO ESFORÇO DA RNP

IMPLANTAÇÃO DE SERVIÇOS

E

INDUÇÃO DE PESQUISA E DESENVOLVIMENTO

NÃO
- Implantação de P&D
- e
- Indução de serviços

INDUÇÃO DE TAREFAS DE P&D

- Mailing Systems
- Archive Servers
- X.500 & Distributed Directories
- Integration INTERNET/OSI
- Library querying applications
- Data Compression
- Image transmission
- Authentication
- National Character Sets
- Document Architecture

INDUÇÃO DE TAREFAS DE P&D (Cont.)

- Network Management
- TCP/IP over VSAT
- Vertical distribution of processing
- Visualization
- Packet Radio
- Secondary education applications
- Organizational changes

UPDATE ON BRAZIL (NOV/1992)

1. PHYSICAL INFRASTRUCTURE

A. THE UNCED (RIO-92, GLOBAL SUMMIT) HELD IN RIO DE JANEIRO IN JUNE 1992 MADE URGENT THE INSTALLATION OF NEW CIRCUITS, ESPECIALLY THE 64 KBPS CONNECTIONS FROM RIO AND SÃO PAULO TO THE US, AND THE 64 KBPS BACKBONE OF THE RIO DE JANEIRO STATE NETWORK. THESE CIRCUITS WERE DELIVERED IN MAY!

B. THE "CENTRAL TRIANGLE" (BSB-RJ-SP) OF THE RNP BACKBONE WILL BE UPGRADED TO 64 KBPS, AND WILL USE CISCO ROUTERS BY MARCH 1993.

NOTE: THIS WILL PERMIT THE USE OF BACKUP ROUTING ON CONNECTIONS TO THE US.

2. RNP INFRASTRUCTURE

A. CENTRES FOR OPERATIONS / INFORMATION SERVICES / TRAINING WILL BE SET UP IN BSB / RJ / SP BY THE END OF THIS YEAR, AND IN NE BRAZIL AND THE NORTH BY MID-1993.

B. TRANSLATIONS INTO PORTUGUESE:

A NUMBER OF KEY (USER) PUBLICATIONS WILL BE TRANSLATED INTO PORTUGUESE. ALREADY TRANSLATED ARE:

ZEN AND THE ART OF THE INTERNET
BY BRENDAN KEHOE

and

THE NEW HACKER'S DICTIONARY
(ED. ERIC RAYMOND)

3. RNP APPLICATIONS (SERVICE ORIENTED P+D)

A. VISUALLY DEFICIENT USERS; HIGH SCHOOL STUDENTS

installation as from MAR/93 } SP/MG/RJ
operations JUL/93 }

⇒ pilot HIGH SCHOOL NETWORK (DEZ/93)

B. ELECTRONIC MAIL (AND OTHER APPLICATIONS) IN PORTUGUESE (WITH FULL CHARACTER SET)

initial utilization MAR/93
final proposal JUL/93

C. CENTRE FOR COMPUTATIONAL MOLECULAR BIOLOGY, WITH SOFTWARE, DATABASES AND CONTINUOUS UPDATING FROM ABROAD.

BY DEC/92 IN BRASÍLIA OR BELO HORIZONTE

BY DEC/93 4 COMPLEMENTARY CENTRES IN BRASIL

FROM MAR/93 (FREE) ACCESS TO USERS FROM OTHER COUNTRIES IN REGION.

D. WAIS AND INTERFACE TO MINI/MICRO ISIS

Final tests by DEC/92.
Service available MAR/93

E. GATEWAY X.400/SMTP AND INTERFACE WITH STM-400 (commercial X.400)

Final tests by MAR/93
Proposal for service by JUL/93

F. X.500 EXPERIMENT

Planning complete by DEC/92
Deployment complete by JUL/93
Experimental operation from AUG/93

⇒ PROPOSAL FOR REGIONAL COOPERATION BY JUL/93.