Integrating Latin American and European Research and Education Networks through the ALICE project

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Michael Stanton
Member, CLARA Technical Committee
Rede Nacional de Ensino e Pesquisa do Brasil - RNP
<michael@rnp.br>

Cathrin Stöver
Project Manager, ALICE Project
DANTE
<cathrin@dante.org.uk>

A Brief Story of Networking in Latin America

- Political, linguistic and cultural considerations have traditionally led to considerable interaction between countries within the region

However, networking has not followed this model:

- First connections (BITNET) starting 1986 using satellite links between the US and each country separately
- Same topology inherited with transition to Internet
- Even multilateral initiatives (RedHUCyT in mid 90s and AMPATH from 2001) have used traffic hubs in the US.

First global conections from LA countries

Two “classical” phases of connectivity:

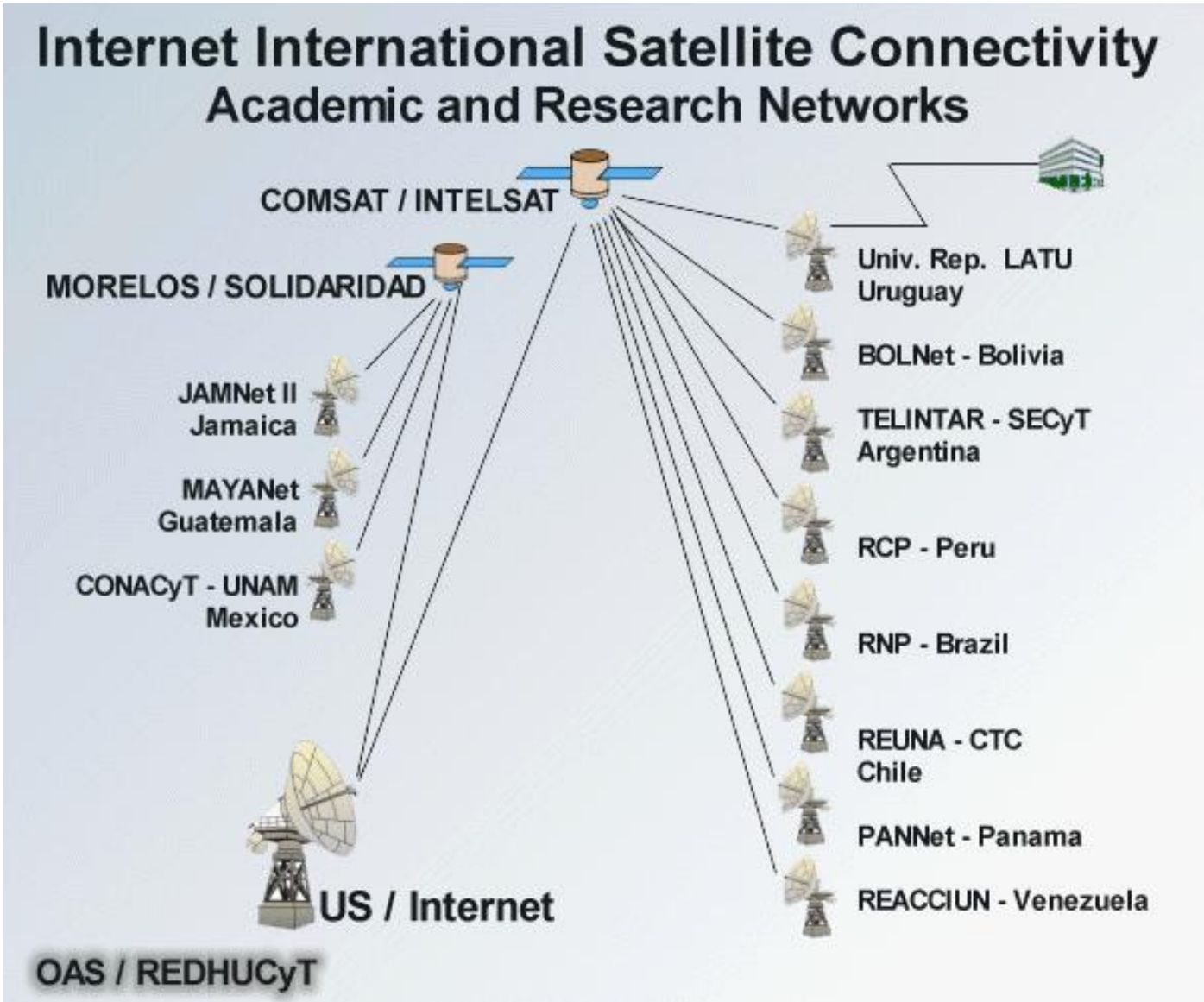
- e-mail networks (BITNET, UUCP)
- full Internet (IP) connectivity

- Table shows the first connections for each LA NREN (National Research and Education Network)

	MX	CL	BR	NI	UY	PY	VE	AR	CR
e-mail	86	86	88	88	88	89	90	90	90
IP	89	92	91	94	94	95	92	93	93

	CO	EC	PE	BO	CU	PA	GT	SV	HN
e-mail	90	91	91	91	91	92	92	94	94
IP	94	92	94	95	96	94	95	96	95

Internet International Satellite Connectivity
Academic and Research Networks



ALICE
America Latina Interconectada Con Europa

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Influence of telecommunications infrastructure

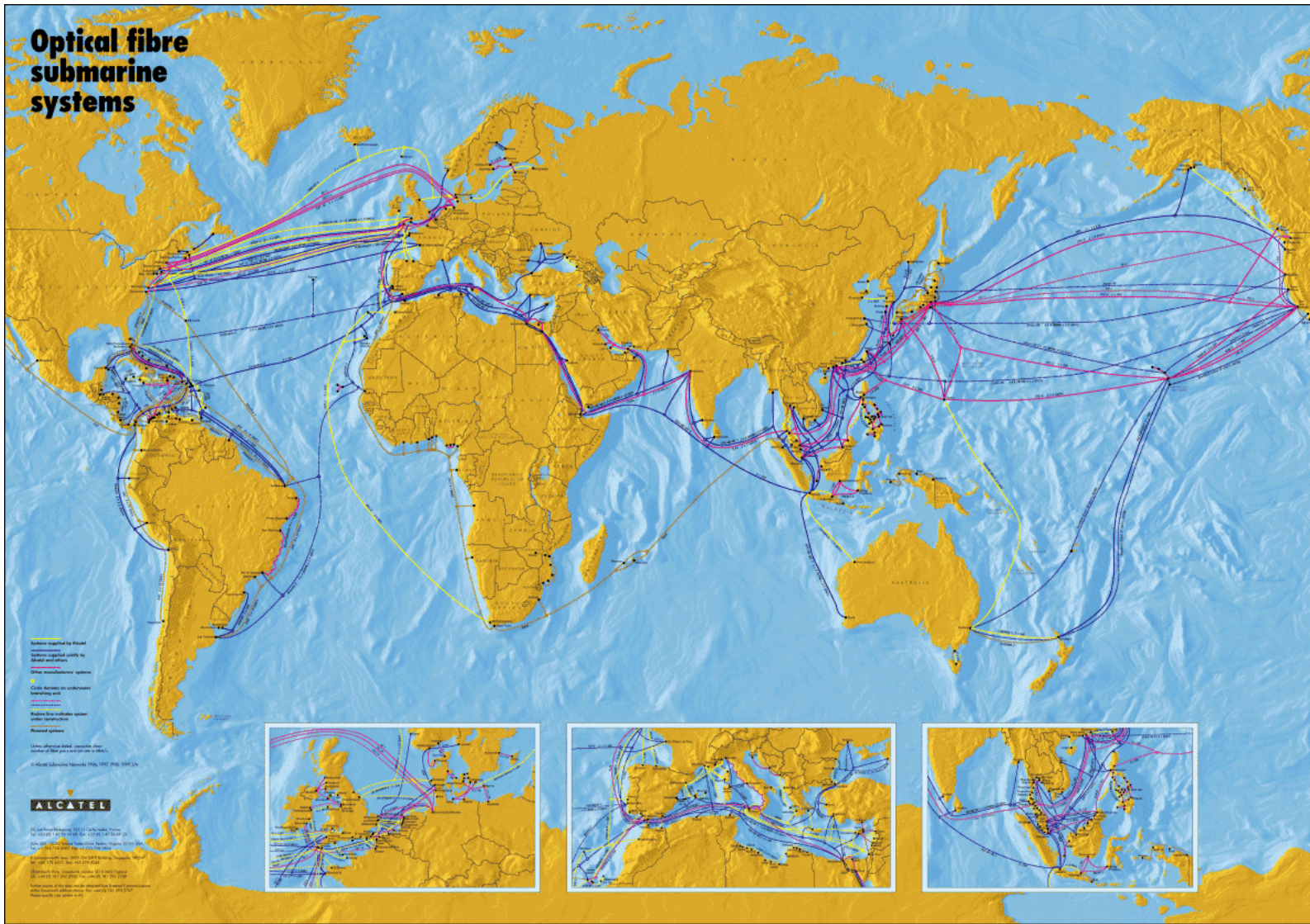
- Until very recently, the only available telecom infrastructure for data communication was by satellite
  - cost independent of distance
  - no incentive for establishing links within the region, as all countries were mainly interested in access to global Internet

- Recent important changes (since late 1990s):
  - end of state telecom monopoly in many countries
    - competition and lower prices
    - most LA NRENs replaced by commodity IP providers (for economic or political reasons)
  - building out of new infrastructure based on submarine fibre optical cables

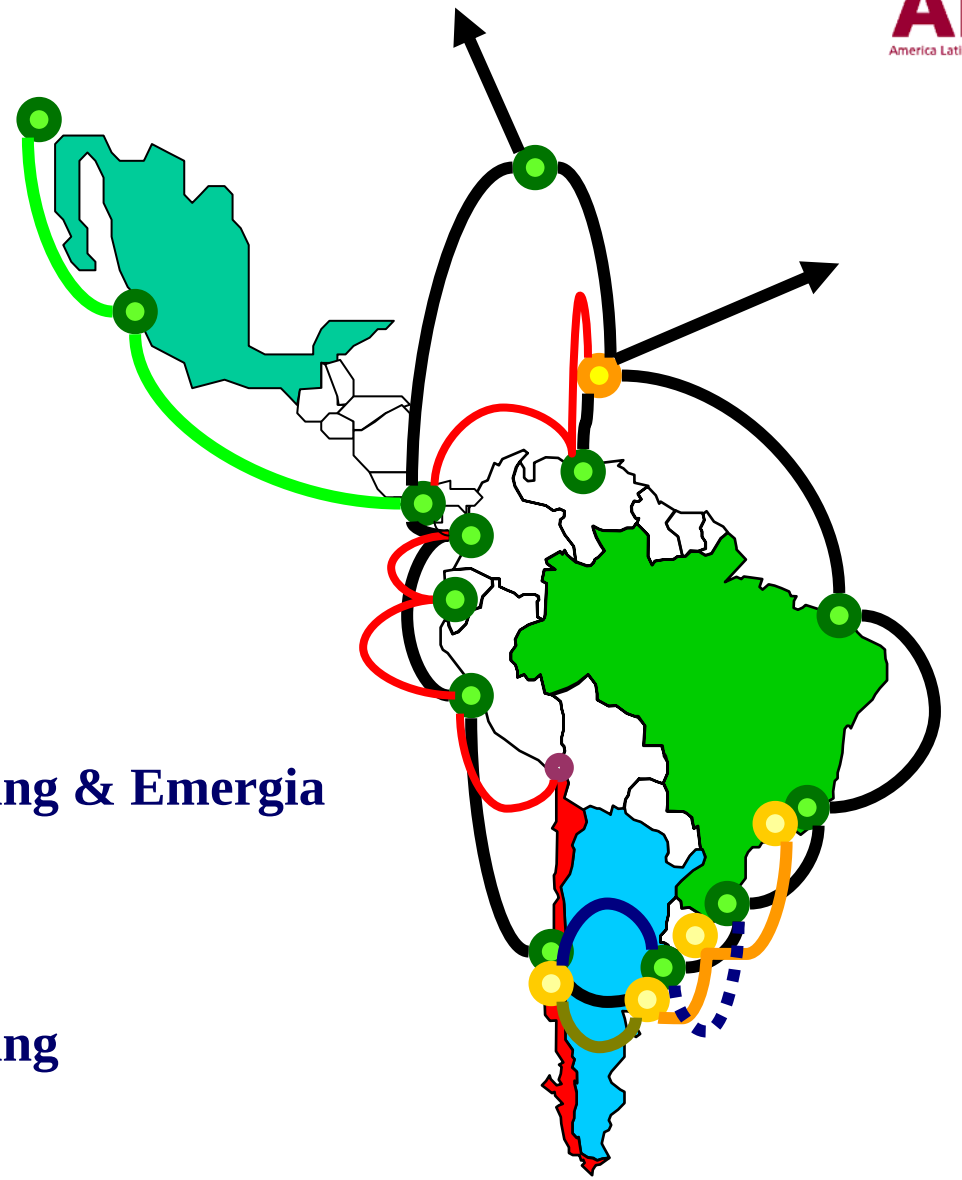
Optical cable infra-structure

- Advances in optical transmission technologies have recently made it possible to build very long distance undersea communications systems based on DWDM
- In the late 1990s, many new DWDM cable systems were built, vastly increasing the installed capacity
- Principal new undersea cable operators in Latin America:
  - Global Crossing
  - Telefonica International Wholesale Services (e-mergia)
  - New World Networks (ARCOS cable)

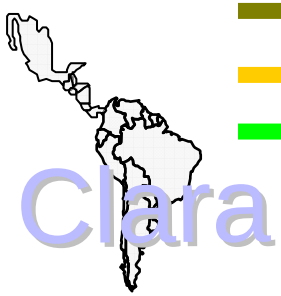
Worldwide Submarine Optical Cables – 2002



New Optical Cables in Latin America



- Panamerican
- Global Crossing & Emergia
- ImpSat
- Transandino
- UniSur
- Global Crossing



New cables in the Caribbean (Maya & Arcos)

Maya

Arcos (festoon)

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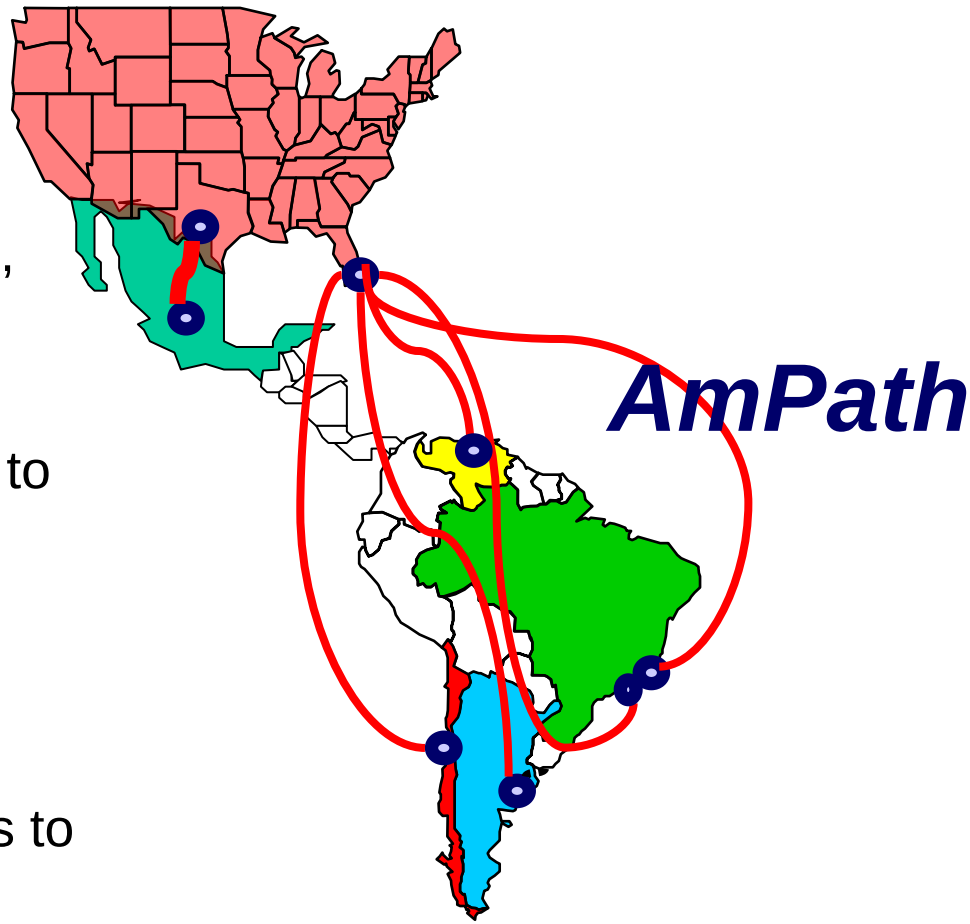
Internet2

- Until 1995, the USA maintained a national R&E network called NSFNET, created in 1986.
  - When NSFNET was created, there was no equivalent commodity service
- In 1995 all US R&E users were obliged to seek IP service from commodity providers
- In 1996, the Internet2 project was created, to provide “advanced networking” service to the R&E community, through the Abilene network
- Similar initiatives have been taken in other countries, especially Canada, Europe and Japan.
- Today, Internet2 connectivity is an important characteristic of R&E networking worldwide.

Present Internet2 Connectivity in Latin America

AmPath

- uses Global Crossing
- connects AR, BR (2), CL, VE
- 45 Mbps
- all connections are point to point from Miami, and thence to Abilene



Mexico

- cross-border connections to USA (TX and CA)

Present State of Latin American NRENs

Established education and research networks:

- With dedicated Internet2 connections:
  Argentina, Brazil, Chile, Mexico, Venezuela
- Some with dedicated int'l connectivity:
  Cuba, Uruguay

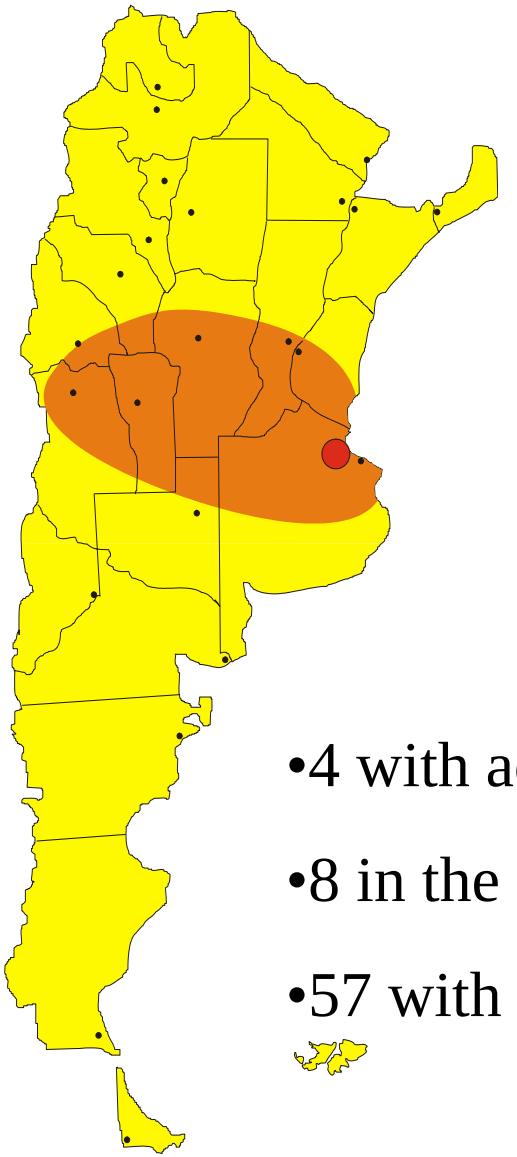
Education and research networks being re-established (present nat'l/int'l connectivity through commercial ISPs)

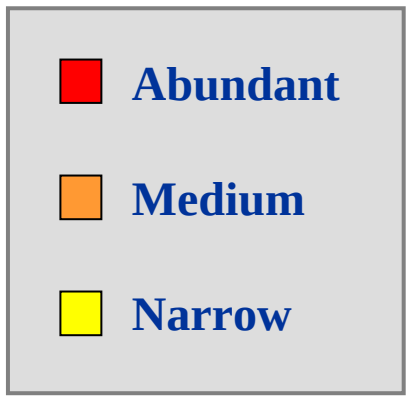
- Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Panama, Peru, Paraguay, El Salvador

No education/research network (most connected to Internet via commercial ISPs): Nicaragua, Honduras, Dominican Republic, Haiti, rest of Caribbean

Argentina – RETINA (www.retina.ar)

- 45 Mbps to AmPath

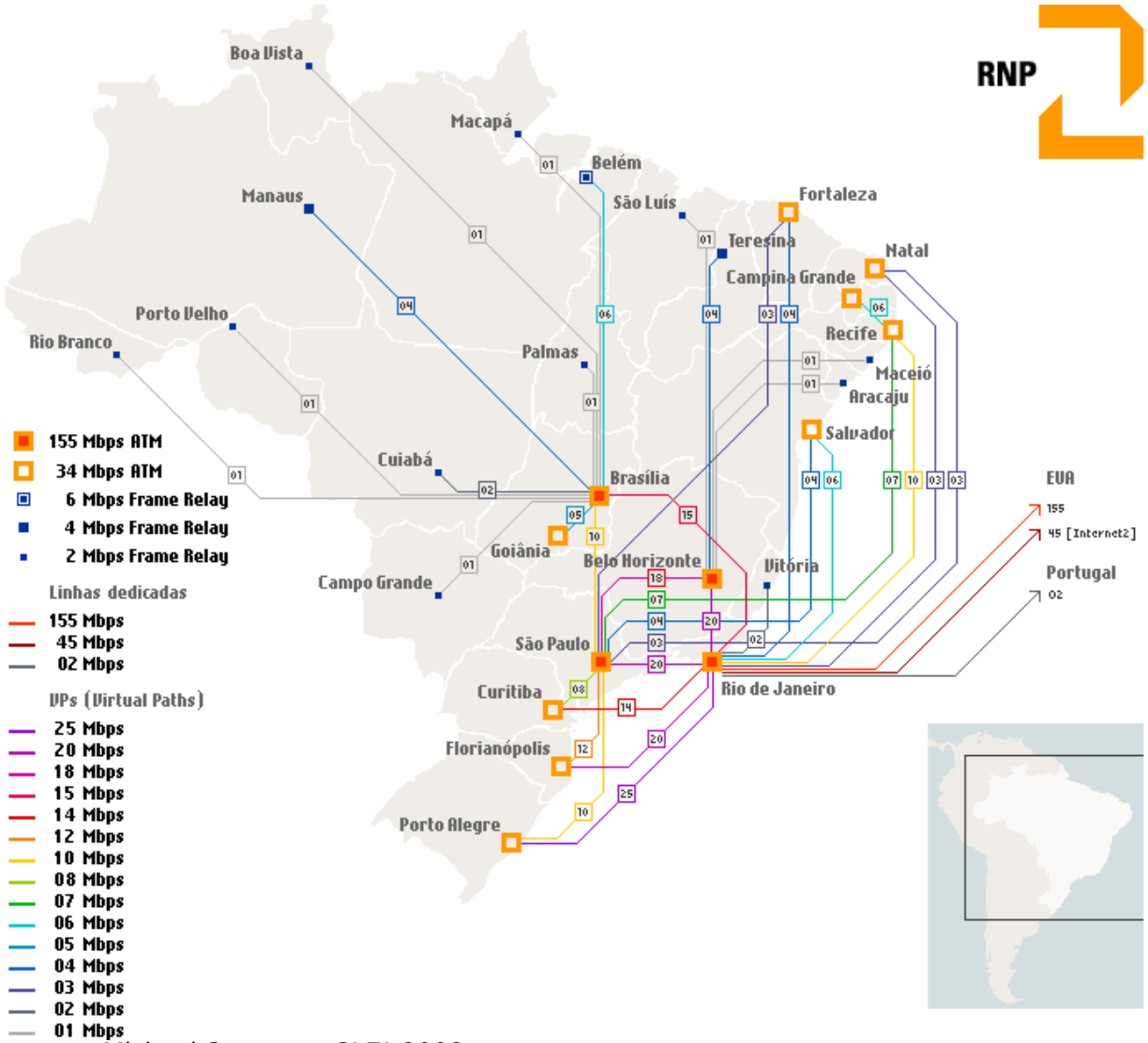




- 4 with advanced connectivity
- 8 in the near future
- 57 with low connectivity

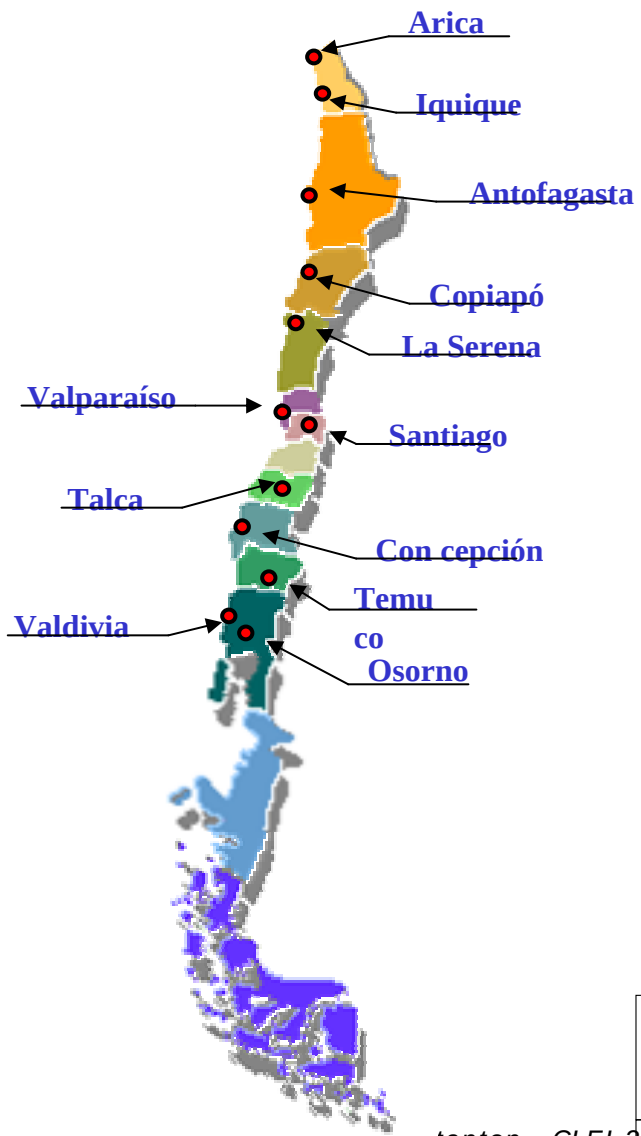
Brazil – RNP (www.rnp.br/index_en.html)

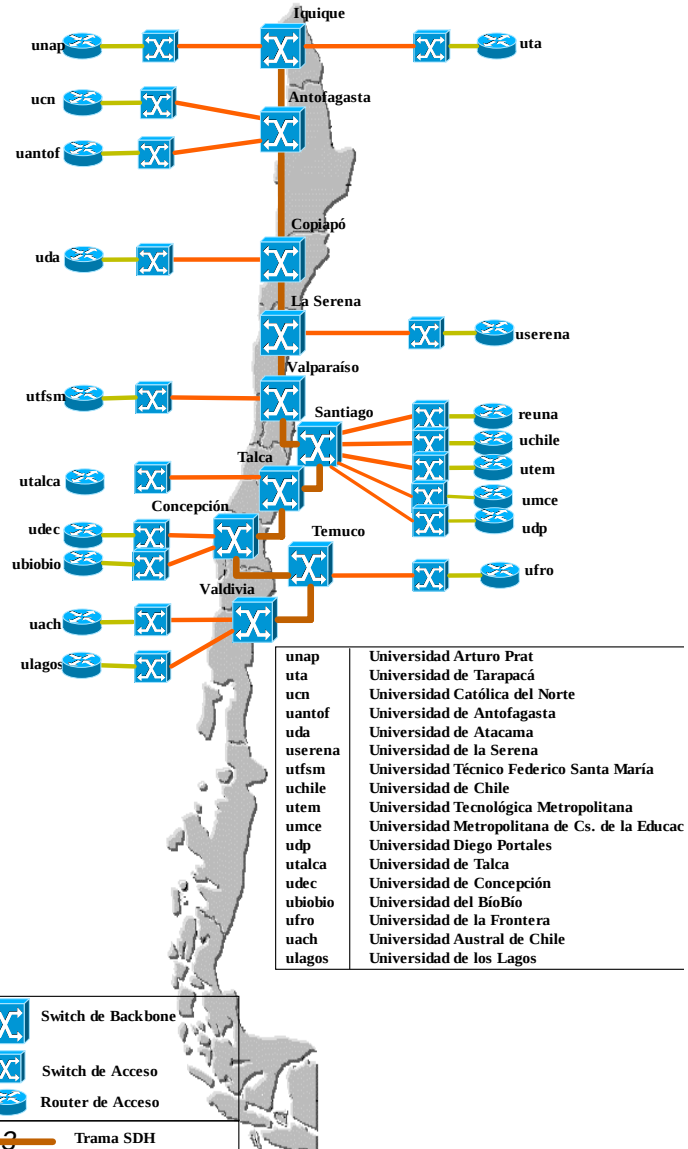
- ATM backbone
  - 14 nodes
  - 300 Mbps total b/w
- FR to other PoPs
- 15 state networks
- Aggregate int'l b/w over 400 Mbps (incl. 90 Mbps to AmPath)
- new backbone in 4Q2003



Chile – REUNA (www.reuna.cl)

- ATM backbone
  - 10 nodes
  - 10/60 Mbps
- 45 Mbps to AmPath





Mexico – CUDI (www.cudi.edu.mx)

- Internal links at 155 Mbps
- 400 Mbps of int'l connectivity

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Where do we go from here?

- AMPATH´s achievements
  - Initial boost for Advanced Networking in LA
  - Stimulus for advanced connectivity inside each country
  - Motivation for collaborative projects
  - Connectivity needs, delayed till now due to high costs, being solved

BUT

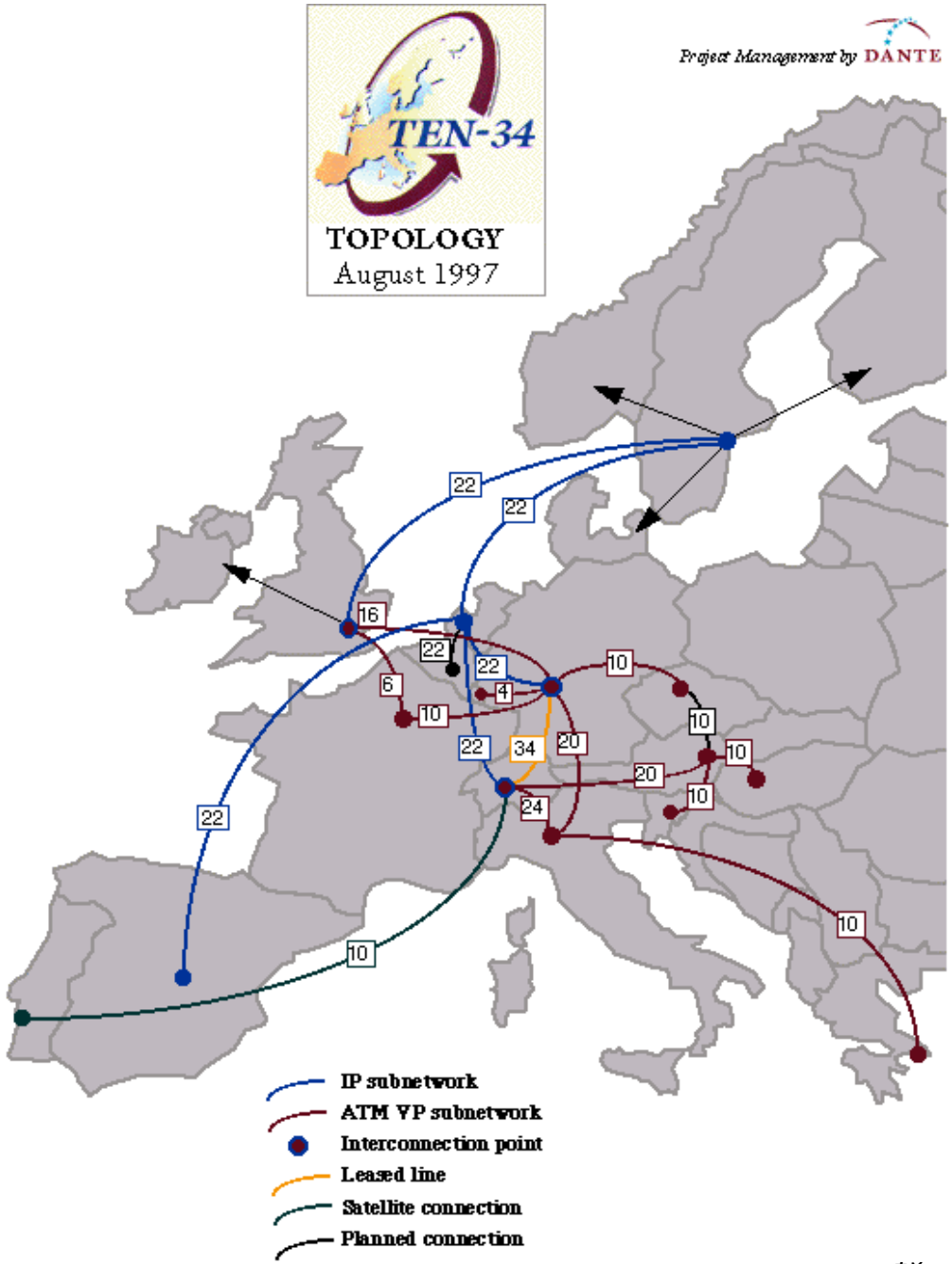
- Why does LA communicate internally through Miami?
- Why does LA communicate with other parts of the world through the US?

DANTE and Pan-European R&E networking

- In Europe, global networking also began with direct BITNET and IP links to the US from separate countries
- Since the early 1990s great efforts have been invested in pan-European networking, through the creation of a series of regional backbone networks:
- These networks have been built and managed by DANTE (Delivering Advanced Networking Technology to Europe), with financing by European NRENs and the EU
- Four versions of the pan-European backbone network
  - EuropaNET (1992-1997)
  - TEN-34 (1997-1998)
  - TEN-155 (1998-2001)
  - GÉANT (2002-)

TEN-34

- Trans-European Network at 34 Mbps
- 20 countries
- operational in 1997
- backbone speed inferior to internal NREN links (cost of int'l links)



TEN-155

- Set up after liberalisation and harmonisation of European telecom industry
- Much cheaper int'l connectivity within Europe
- In some countries liberalisation delayed