Integrating Latin American and European Research and Education Networks through the ALICE project
October 2003

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 connections 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)

<table>
<thead>
<tr>
<th></th>
<th>MX</th>
<th>CL</th>
<th>BR</th>
<th>NI</th>
<th>UY</th>
<th>PY</th>
<th>VE</th>
<th>AR</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail</td>
<td>86</td>
<td>86</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>89</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>IP</td>
<td>89</td>
<td>92</td>
<td>91</td>
<td>94</td>
<td>94</td>
<td>95</td>
<td>92</td>
<td>93</td>
<td>93</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>CO</th>
<th>EC</th>
<th>PE</th>
<th>BO</th>
<th>CU</th>
<th>PA</th>
<th>GT</th>
<th>SV</th>
<th>HN</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail</td>
<td>90</td>
<td>91</td>
<td>91</td>
<td>91</td>
<td>91</td>
<td>92</td>
<td>92</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>IP</td>
<td>94</td>
<td>92</td>
<td>94</td>
<td>95</td>
<td>96</td>
<td>94</td>
<td>95</td>
<td>96</td>
<td>95</td>
</tr>
</tbody>
</table>
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)
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.
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](http://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
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:
  - 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