AMPATH

Pathway of the Americas

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AMPATH Project

- Started in March 2000 as a project led by Florida International University (FIU), in collaboration with Global Crossing (GX), to interconnect the National Research and Education Networks (NRENs) in South and Central America, the Caribbean and Mexico to US and non-US NRENs
- With donations of
 - 10 DS3s and collocation from GX for 3 years
 - GSR 12012 router from Cisco
 - CBX 500 Carrier Class ATM switch from Lucent
 - M10 router from Juniper
 - Collocation in the NAP of the Americas from TWW for 3 years
- Partial funding from the National Science Foundation's Advanced Networking Infrastructure & Research (ANIR) Division







AMPATH Project Goals

- Work with the NRENs of each country in the AMPATH Service Area to
 - enable participating countries to contribute to the research and development of wide-bandwidth applications for the advancement of Internet technologies
 - extend the global research and education community for high-performance networking to South and Central America, the Caribbean and Mexico





International R&E XP in Miami

- AMPATH serves as the international exchange point in Miami for research and education networks from Latin America to the US
- Serves as Latin America's access point to Internet2's Abilene network and non-US NRENs, connecting
 - REUNA of Chile
 - RNP of Brazil
 - RETINA of Argentina
 - ANSP of Sao Paolo, Brazil
- Connects US funded projects in the Service Area:
 - University of Puerto Rico
 - Arecibo Observatory
 - Gemini Observatory
- Experimental connection to StarLight
- Located in the NAP Of The Americas





AMPATH Service Area



Florida International University

AMPATH

South

Central

Mexico

America

America

Caribbean



- Fifth Tier-1 NAP
- Strategically located to serve Latin America, the Caribbean, Southern Europe and Africa
 Close to major carrier POPs and 7 worldwide
- Close to major carrier POPs and 7 worldwide undersea cable landings



International Cable Landings



Inter-Regional Aggregation

- Miami is ranked 8th in the top 50 Inter-Regional Internet hub cities
- In the top 50 Inter-Regional Internet Routes, Miami ranks
 - 10th in aggregate bandwidth of 3.4Gbps to Sao Paolo
 - 14th in aggregate bandwidth of 2.5Gbps to Madrid
 - 18th in aggregate bandwidth of 1.5Gbps to Buenos Aires
- Miami is ranked 1st in the top 10 International Internet Hub cities for Latin America and the Caribbean

Source: Packet Geography, 2002





AMPATH Network Services

- ATM and Optical Ethernet peering fabrics
- Intraregional peering over Layer 2 services, including IP VPNs
- IPv6
 - Tunneled now
 - Native after Abilene goes native
- Multicast
- End-to-End performance measurement and monitoring
- VRVS server for Video-over-IP
- Flow-based and QoS-based monitoring using netflow tools







TransPAC
Euro-Link
MIRnet
AMPATH
STAR TAP

The Global Research Network Operations Center (Global NOC) at Indiana University manages the international network connections from advanced research and education networks in the Asia/Pacific, Europe, Russia and South America to the Science Technology and Research Transit Access Point (STAR TAP) and the leading US high performance research and education networks such as Abilene (the network that supports the Internet2 project), the NSF's very high performance Backbone Network System (vBNS) and the Department of Energy's ESNET.

More Information

Abilene

Email: globalnoc@iu.edu

Intraregional Connectivity

- Latin America's intraregional Internet infrastructure and bandwidth continues to grow
 - Increased by a factor of 25 in one year
 - GX and Emergia submarine cable systems' capacity is approaching 400 Gbps

City, Country	City, Country	Internet Bandwidth (Mbps)
Buenos Aires, Argentina	Santiago, Chile	824
Buenos Aires, Argentina	Sao Paolo	666
Buenos Aires, Argentina	Montevideo, Uruguay	193
Lima, Peru	Santiago, Chile	155



Source: Packet Geography, 2002



Interregional Connectivity

- Miami has become Latin America's largest telecom hub
 - Connects almost half the region's international Internet bandwidth
 - Absorbs routes shifted from NY or Europe
- AMPATH's connection to Abilene will be upgraded to an OC12
- Interregional connectivity from Miami

City, Country	City, Country	Internet Bandwidth (Mbps)
Miami, US	Sao Paolo, Brazil	3,384
Madrid, Spain	Miami, US	2,488
Buenos Aires, Argentina	Miami, US	1,455
Miami, US	Santiago, Chile	503



Source: Packet Geography, 2002



In-Country Challenges

- Research universities need increases in bandwidth capacity
 - Not enough bandwidth to the researchers
- Identify regional flagship applications
 - High-Energy Physics
 - Large Hadron Collider (LHC) program is a multi-nation collaborative program that involves Brazil
 - 2.5 10 Gbps bandwidth capacity required
 - Astronomy
 - Atacama Large Millimeter Array (ALMA) project consists of (64) 12 meter antennas located in Chile
 - At least 300 Mbps bandwidth capacity required



http://www.ampath.fiu.edu/Report%20Final.pdf



GTRN-Level Connectivity Challenges

- Regional aggregation in South America with interregional connectivity to Miami and other interregional aggregation points
- Minimum STM-4 interregional links
- More intraregional terrestrial fiber infrastructure to facilitate development of Gigabit-level applications







Pathway of the Americas

Thank You

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Florida International University

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