CHEPREO, AMPATH and Internet2

Presented at QuarkNet Workshop, FIU

July 1, 2004

CHEPREO
CENTER FOR HIGH ENERGY PHYSICS RESEARCH & EDUCATION OUTREACH

CHEPREO IS…

- **An Inter-Regional Center for High Energy Physics Research and Educational Outreach (CHEPREO) at Florida International University**
- GOOD CMS SCIENCE
- EDUCATIONAL OUTREACH
- ***CYBERINFRASTRUCTURE***

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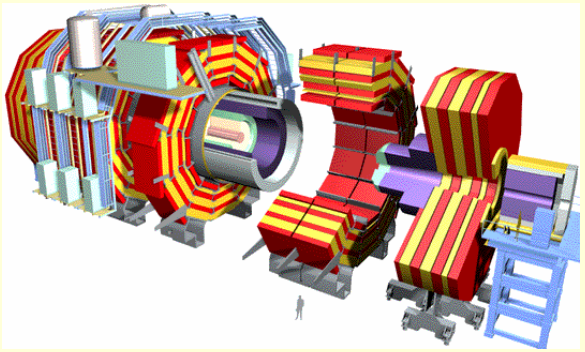
Goals & Accomplishments

- **FIU has joined the CMS experiment**
  - Added two faculty positions in CMS physics
  - Added one Physics Educator Position (now open!)
  - Contribute to Detector Control Systems (DCS)
- **Headquarters for education and outreach efforts in the Physics Learning Center (PLC)**
  - Modeling Introductory University Physics
  - Partner with local High Schools
  - QuarkNet Partner
- **Leverage Networking**
  - AMPATH provides an enabling technology infrastructure
  - FIU is in the process of joining iVDGL
  - Catalysing development of the Latin American Grid (LAGRID)
  - Helping to connect Brazilian HEP led by Professor Alberto Santoro (UERJ) and Professor Sergio Novaes (USP)



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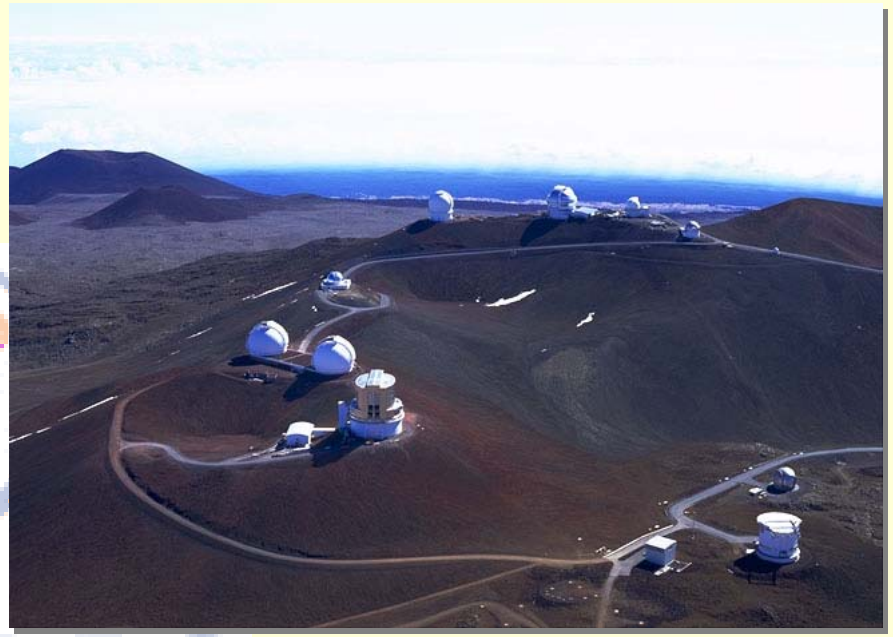
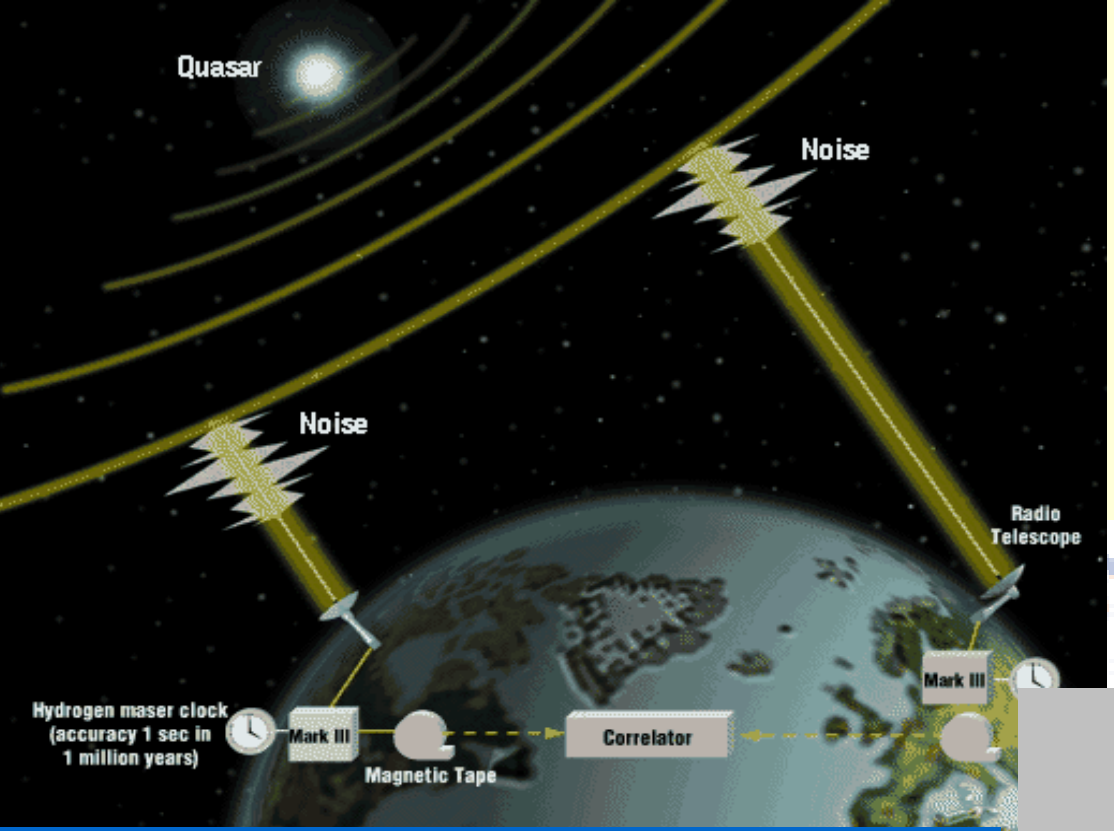
World-class Scientific Instruments

- Gemini-South Optical Observatory
- NRAO telescopes
- *La Serrena, Chile*





ASTRONOMY

- Highest resolution technique available to astronomers – tens of microarcseconds
- Allows detailed studies of the most distant objects

GEODESY

- Highest precision (few mm) technique available for global tectonic measurements
- Highest spatial and time resolution of Earth's motion in space for the study of Earth's interior
  - •Earth-rotation measurements important for military/civilian navigation
  - •Fundamental calibration for GPS constellation within Celestial Ref Frame

CHEPREO Collaboration Build-up

February ’02:	LISHEP Grid Workshop @ UERJ brought us together
March '02:	NSF, iVDGL visited AMPATH @ FIU.
April-June '02:	FIU, UF, FSU, Caltech, UERJ and USP planning
July '02:	FIU, Caltech, UF, FSU, USP visit NSF
August '02:	Visit QuarkNet and USCMS (FNAL, Notre Dame)
October '02:	Quarknet site visit to FIU
November '02:	Funding request to NSF submitted
December '02:	Request for FIU to join CMS during CMS week
December '02:	QuarkNet application approved
January ’03:	NSF Proposal Review
February '03:	Vote on FIU membership during CMS week approved
August ’03:	CHEPREO Project Execution Plan (PEP) and NSF Cooperative Agreements completed
September ’03:	NSF Proposal approved
December ’03:	NSF – CHEPREO Working Meeting in Miami
February ’04:	1st CHEPREO Report Update completed

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CHEPREO Cyberinfrastructure Update

- Networking Activities (AMPATH)
- Implications of Building Global Grids
- International Activities
- CHEPREO networks, grids & Caltech
- FIU Tier 3 Cluster Implementation with UF
- FIU iVDGL Membership
- A Global Grid Enabled Collaboratory
- Florida & National LambdaRail & FiberGLASS
- CMS Cyberinfrastructure (LAGRID)

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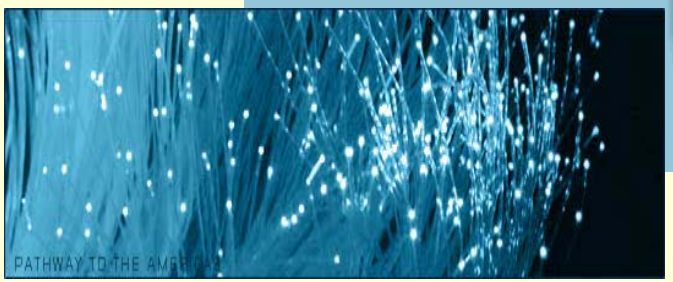
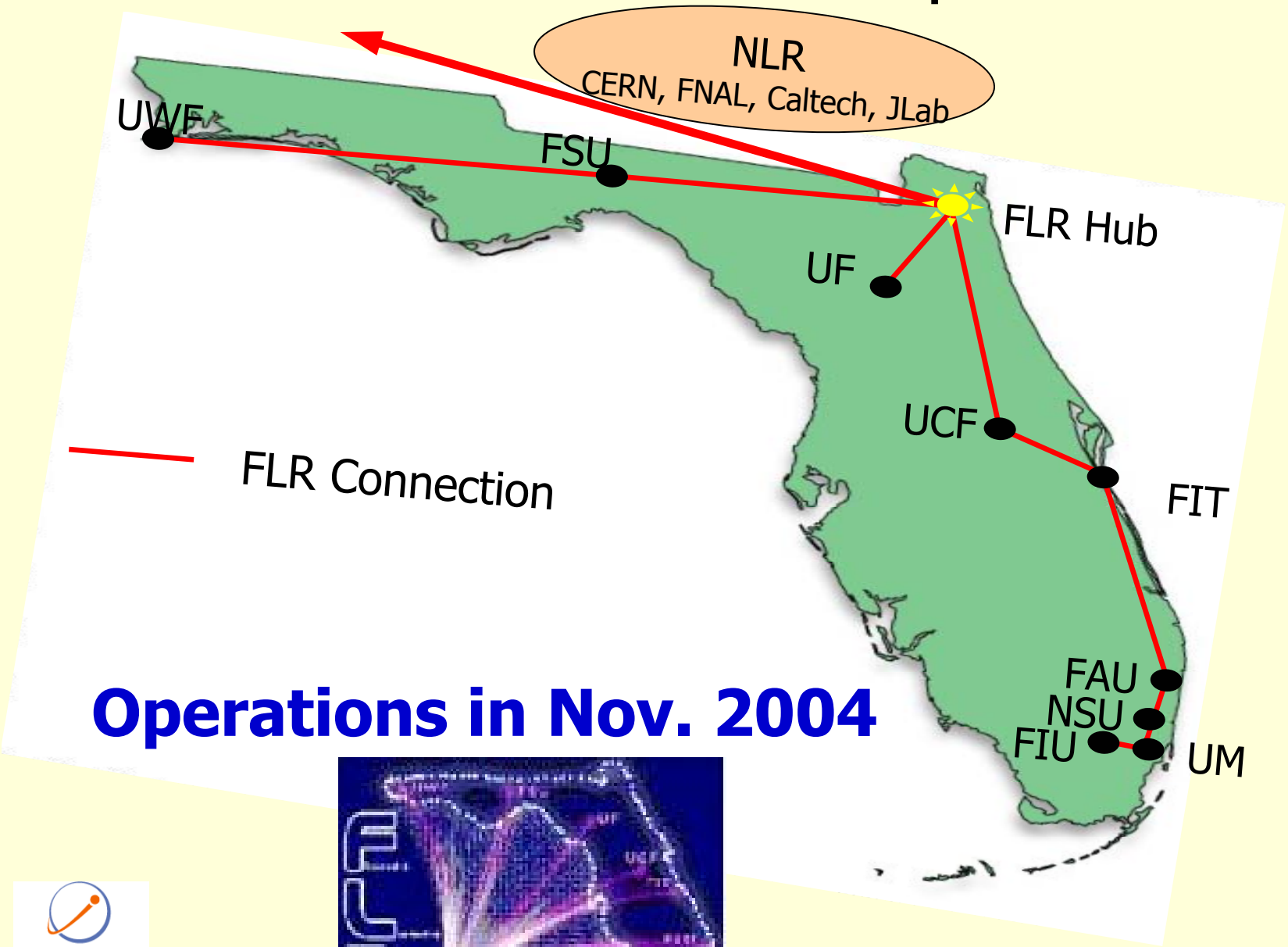
Networking Activities

- FIU, UFL, FSU form State of Florida Research Grid
- Int'l starting point is FIU's AMPATH initiative
- Extend iVDGL to South America
- Serve as pathway for research and education networking
- UERJ collaboration - form LAGRID



Florida LambdaRail: Optical Network



Operations in Nov. 2004

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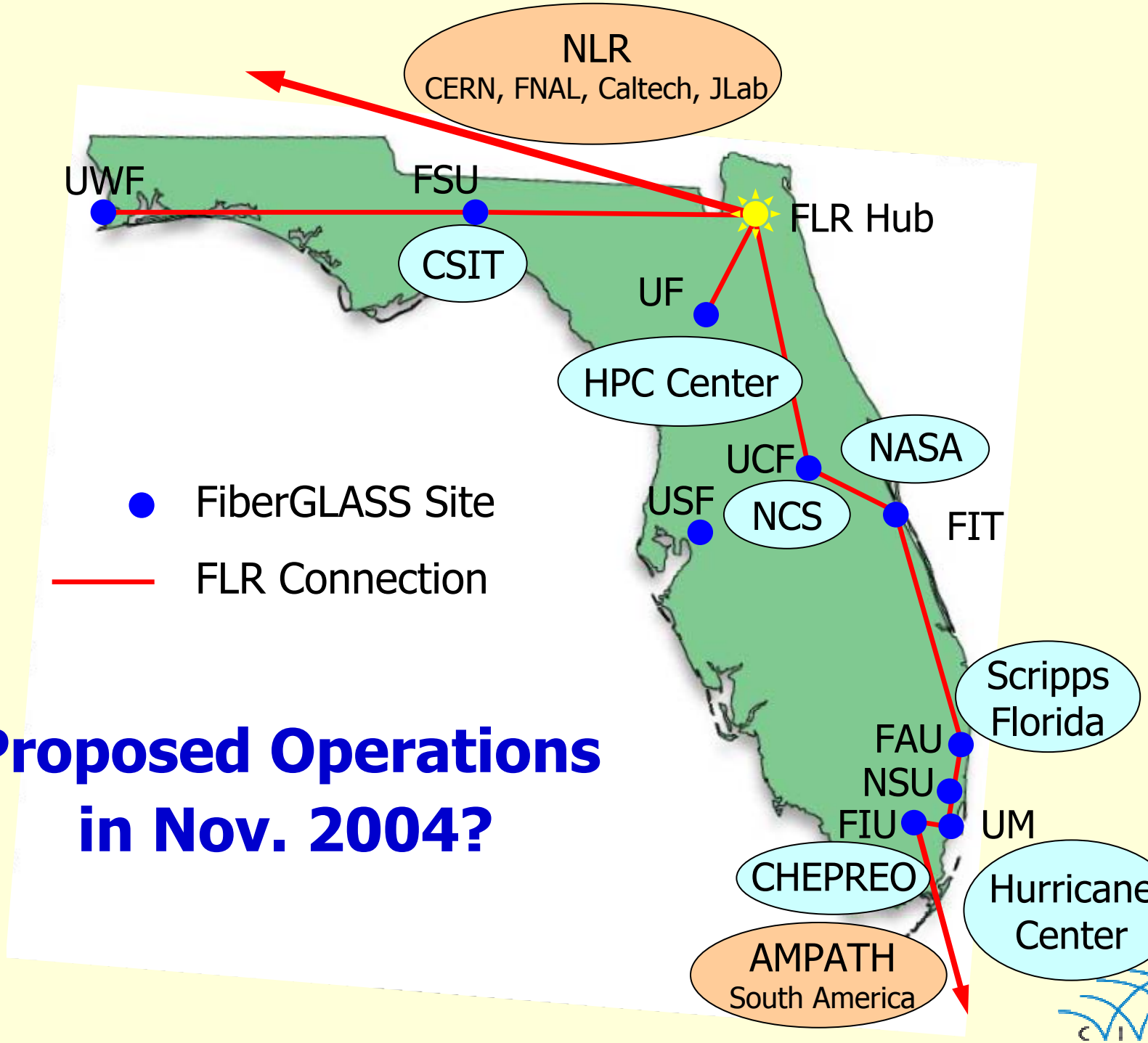
FiberGLASS: A Statewide Grid Using FLR



Proposed Operations in Nov. 2004?

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CMS Cyberinfrastructure

- **LAGRID: A Data Grid for the Americas**
  - FIU-AMPATH is working with our US and Brazilian partners to:
    - Extend iVDGL to FIU and South America
    - Enhance participation of D-Zero in South America
    - Extend US-CMS Grid testbed & Grid2003 to UERJ
  - Facilitate institutions from South and Central America to join the CMS collaboration

AMPATH™: Pathway of the Americas

Julio Ibarra, Principal Investigator

Heidi Alvarez, Co-Principal Investigator

Chip Cox, Chief of Operations

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AMPATH Background & Summary

- **Launched in March 2000 as a project at Florida International University (FIU), with industry support from Global Crossing (GX), Cisco Systems, Lucent Technologies, Juniper Networks and Terremark Worldwide**

- **Enables network communications between the US research and education networks and 10 National Research and Education Networks (NRNs) in South and Central America, the Caribbean and Mexico**

- **AMPATH is a project at FIU with support from the National Science Foundation's Shared Cyberinfrastructure (SCI) Division for workshops as well as strategic technologies for the Internet Award STI-023184**

http://www.ampath.fiu.edu

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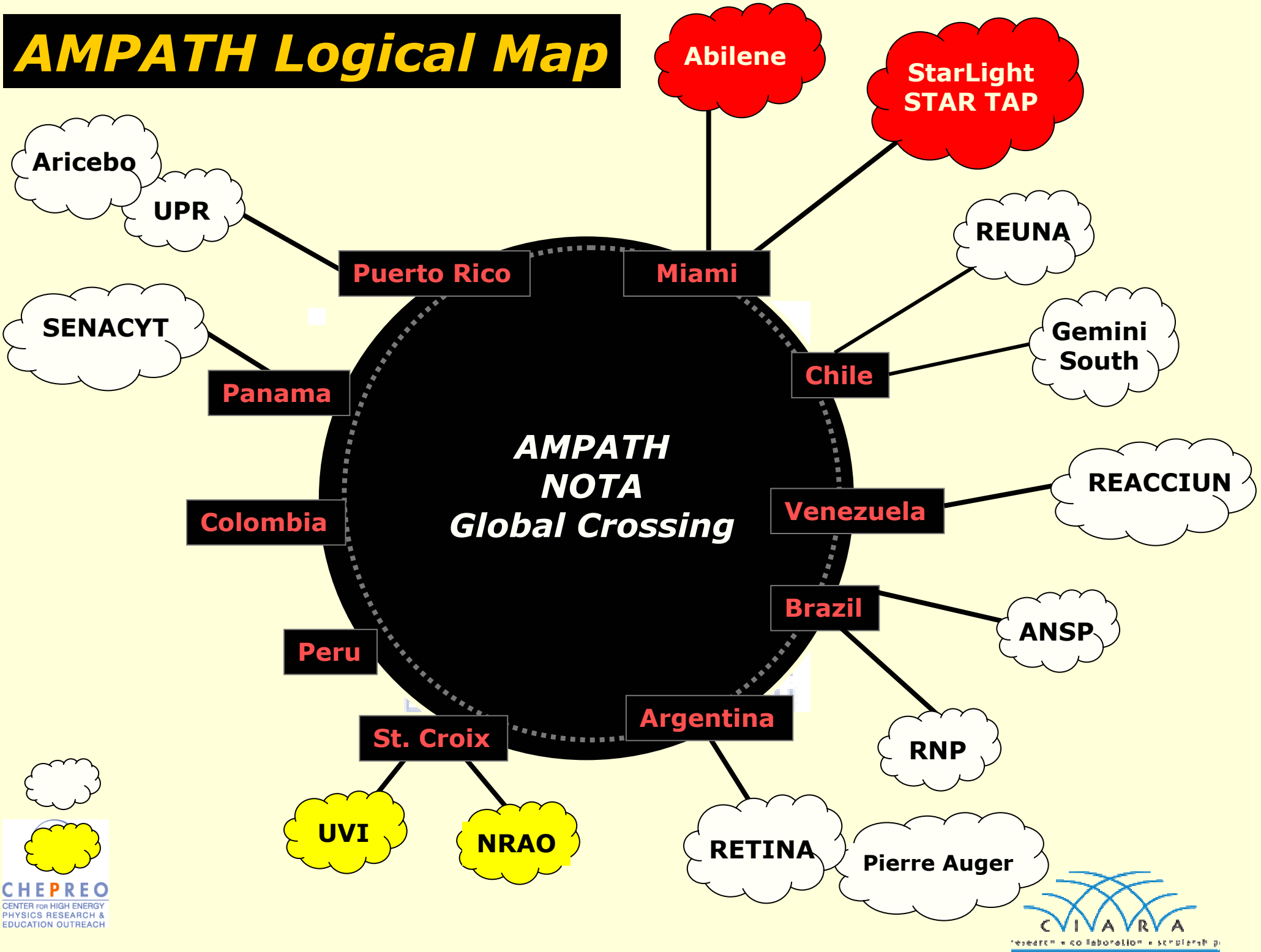
AMPATH Logical Map



Internet2/Abilene

- Internet2® is a not-for-profit consortium, led by over 200 US universities, developing and deploying advanced network applications and technology, accelerating the creation of tomorrow's Internet.
- The Abilene Network is Internet2's high-performance backbone network.

Abilene/Internet2

- The goals of the Abilene Network are to provide an advanced backbone in support of:
  - Cutting-edge applications developed by using innovative, experimental techniques and requiring high-performance network services not available on existing commercial networks.
  - The deployment and testing of advanced services, including multicast, IPv6, measurement, and security, which are generally not possible on the commodity Internet.
  - Connectivity to other research and education networks throughout the world and peering with other federal research networks, thus enabling the international research community to collaborate in new ways.
  - Access for researchers to a rich set of network characterization data collected in a high-performance networking environment supporting new and innovated applications.

Current Abilene Topology

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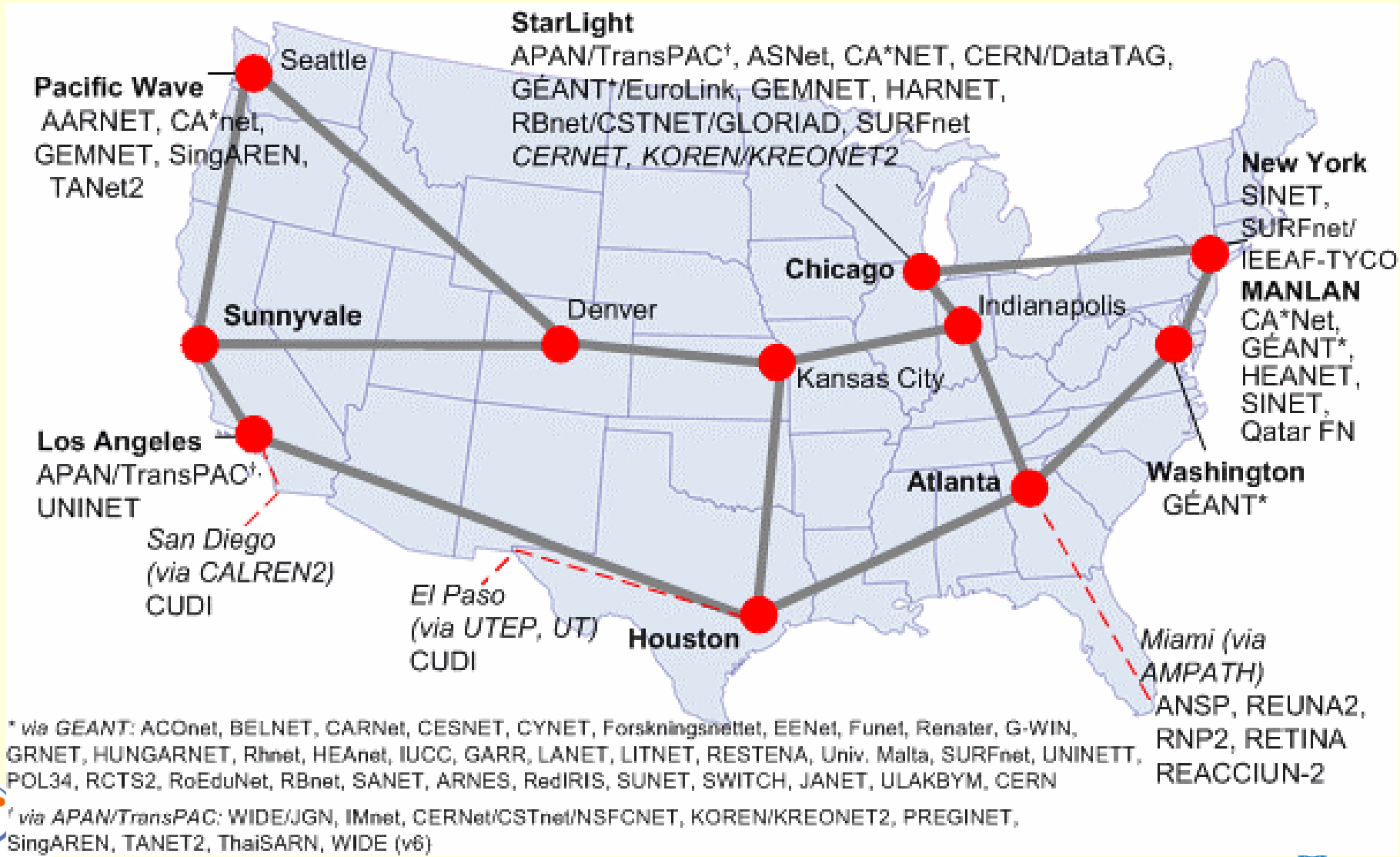
Abilene International Peering



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National LambdaRail

- National LambdaRail (NLR) is a major initiative of U.S. research universities and private sector technology companies to provide a national scale infrastructure for research and experimentation in networking technologies and applications.
- NLR, Inc. has acquired enabling technologies for the project. Cisco has provided enabling technologies including optical DWDM multiplexers, Ethernet switches and IP routers for deployment of NLR infrastructure.

National LambdaRail Architecture

For more information regarding NLR see http://www.nlr.net or contact info@nlr.net

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CHEPREO Cyberinfrastructure

- High-speed peering point for regional and international Research and Education networks
- OC12c to Abilene and 1GbE IP-VPN experimental service to StarLight
- SDH, ATM or IP-VPN transport services
- Available collocation facilities in the NAP of the Americas, in Miami
- Smart-Hands 24x7x365 services at the NAP
- NOC Services from the Indiana Global Research NOC
- Cross-connects through the Meet-Me Room or NAP Gigabit Ethernet fabric
- Policy-free ATM PVCs and 802.1q VLANs for bilateral peering
- Native IPv6, Multicast, VRVS services
- Flow-based and QoS-based monitoring using netflow tools

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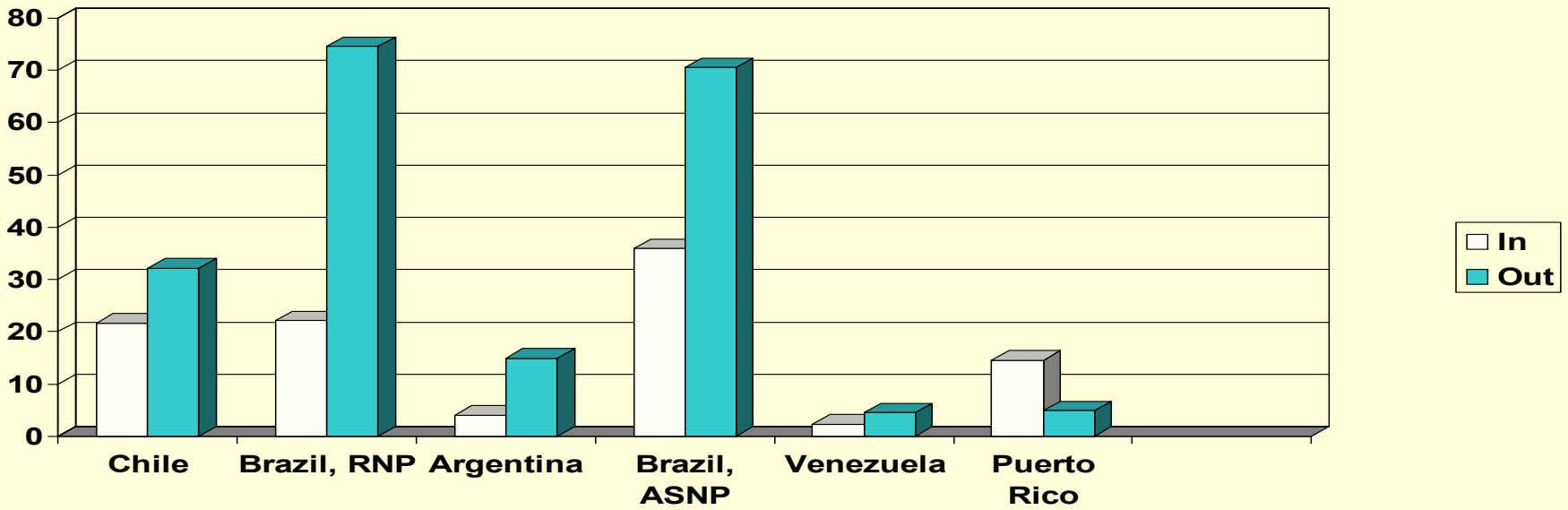
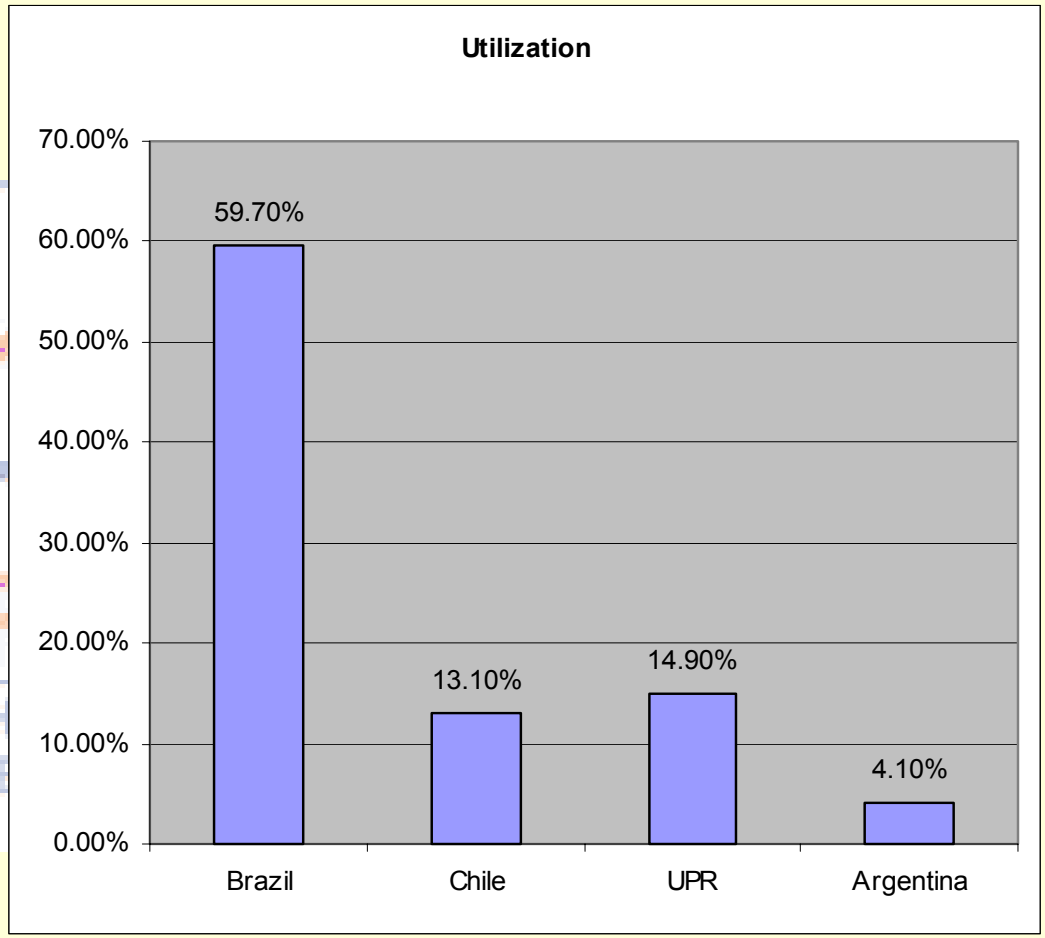
Operations of Network Links



AMPATH/Starlight Traffic Accounting

- Connection activated for the AMPATH workshop, January 2003, interconnecting AMPATH to Starlight using a layer-2 GbE IP-VPN service
- Traffic volume has exceeded 3.4 Tbps – an average of 400 Gbps per month
- Analysis supported by the NSF REU program, STI award ANI-0231844
- Report available at



www.ampath.fiu.edu/Summer03REU.pdf

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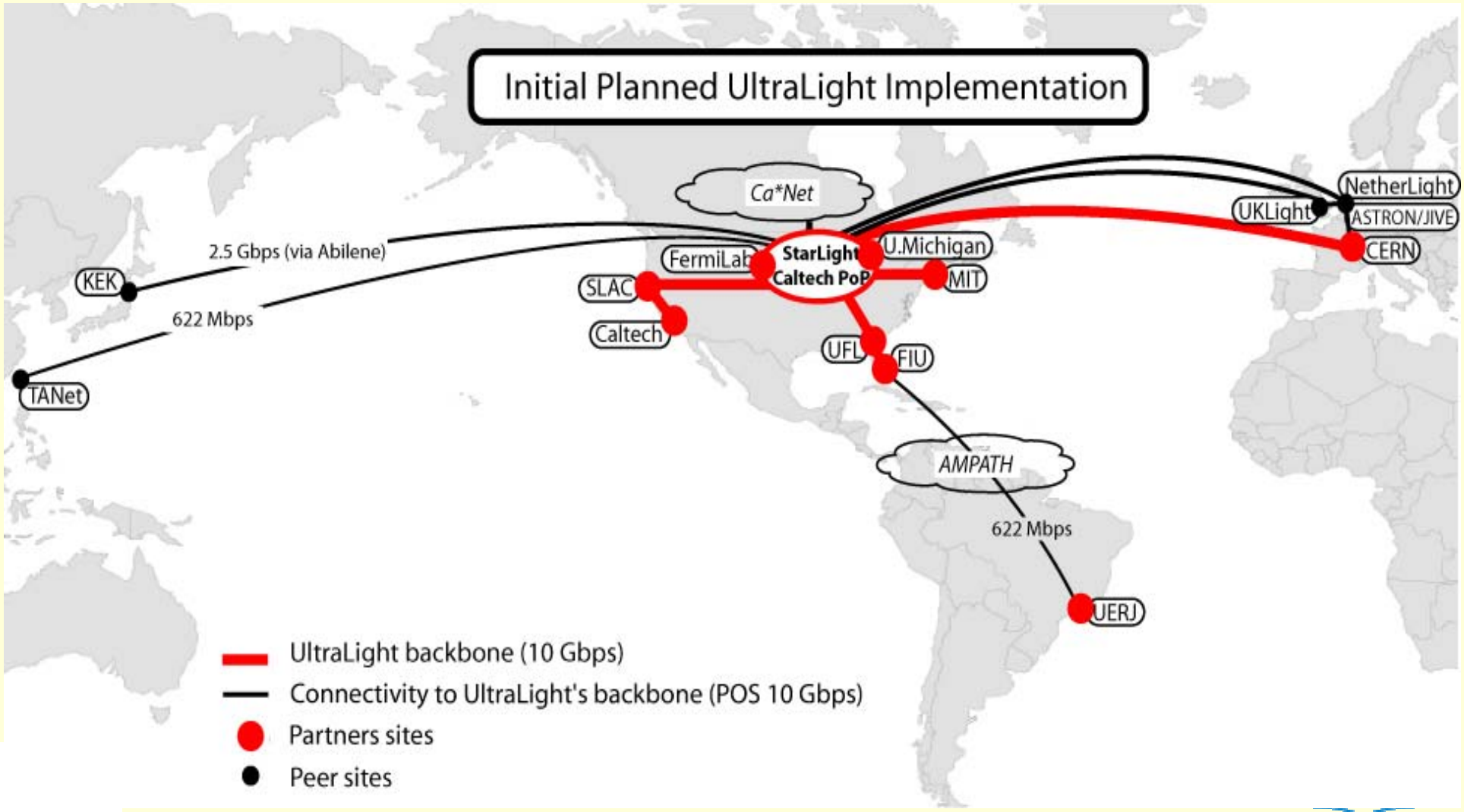
UltraLight: Inter-Regional Research and Experimental Network



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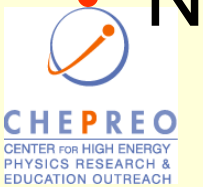
Communities Served

- Argentina – RETINA2
- Brazil – RNP and FAPESP
- Chile – REUNA
- Venezuela – REACCIUN2
- Gemini South optical observatory
- University of Puerto Rico
- Arecibo Radio Observatory
- New World Symphony

Rede Nacional de Ensino e Pesquisa
Promovendo o uso inovador de redes avançadas no Brasil



AMPATH - a community effort

Metrics of Success

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Metrics of Success

- Connections themselves being instantiated
  - A significant effort: 50% complete
    - *Scientists in the workshops expressed significant interest in complete access to collaborators, students, and instruments in Central and South America*
- Grand Challenge Science being Enabled
  - ARECIBO, CHEPREO, and more today
- Education and Outreach

NAP Of The Americas

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Thanks !

- AMPATH infrastructure, science application support, outreach and community building efforts are made possible by funding and support from:
  - National Science Foundation (NSF) awards ANI-0123388, ANI-0220176, ANI-0305879 and ANI-023184
  - Florida International University for support, engineering and stake holders
  - Latin American Research and Education community
- Indiana University NOC for their high-quality NOC Services
- UIC and NWU for STAR TAP and StarLight
- UCAID for Abilene
- Science, Research and Education collaborators that believe in the work that we're doing

Thank You

CHEPREO: www.chepreo.org

AMPATH: www.ampath.fiu.edu