Western-Hemisphere Research and Education Networks - Links Interconnecting Latin America

TIDIA

Information Technology in the Development of Advanced Internet

November 7-9, 2005

Sao Paulo, Brazil

Julio Ibarra, Executive Director

Center for Internet Augmented Research and Assessment (CIARA)

Florida International University

Outline

- The Phenomenon of e-Science
- Cyber Infrastructure Projects Enabling Scientific Work
  - Western-Hemisphere Research & Education Networks (WHREN) - Links Interconnecting Latin America (LILA)
  - AtlanticWave
  - UltraLight
- e-Science Collaborative Projects
  - CHEPREO
  - Cybertools for Biodiversity
  - CyberBridges

Phenomenon of e-Science

CIARA
research • collaboration • scholarship

- Cyber Infrastructure innovations are increasingly changing how science is practiced
  - Science used to about test tubes, wet labs and researchers working individually
  - Science is moving to networks, distributed computers and global collaborations
- Science is increasingly being conducted in virtual laboratory environments
- For a growing number of scientists, “data” is now found on the Web, not in the field (Foster, Science 2005)
- Scientists and organizations are forming virtual working environments where they can share data and computing resources and collectively collaborate to derive new knowledge (Hey, Science 2005)

Large Hadron Collider (LHC) @ CERN

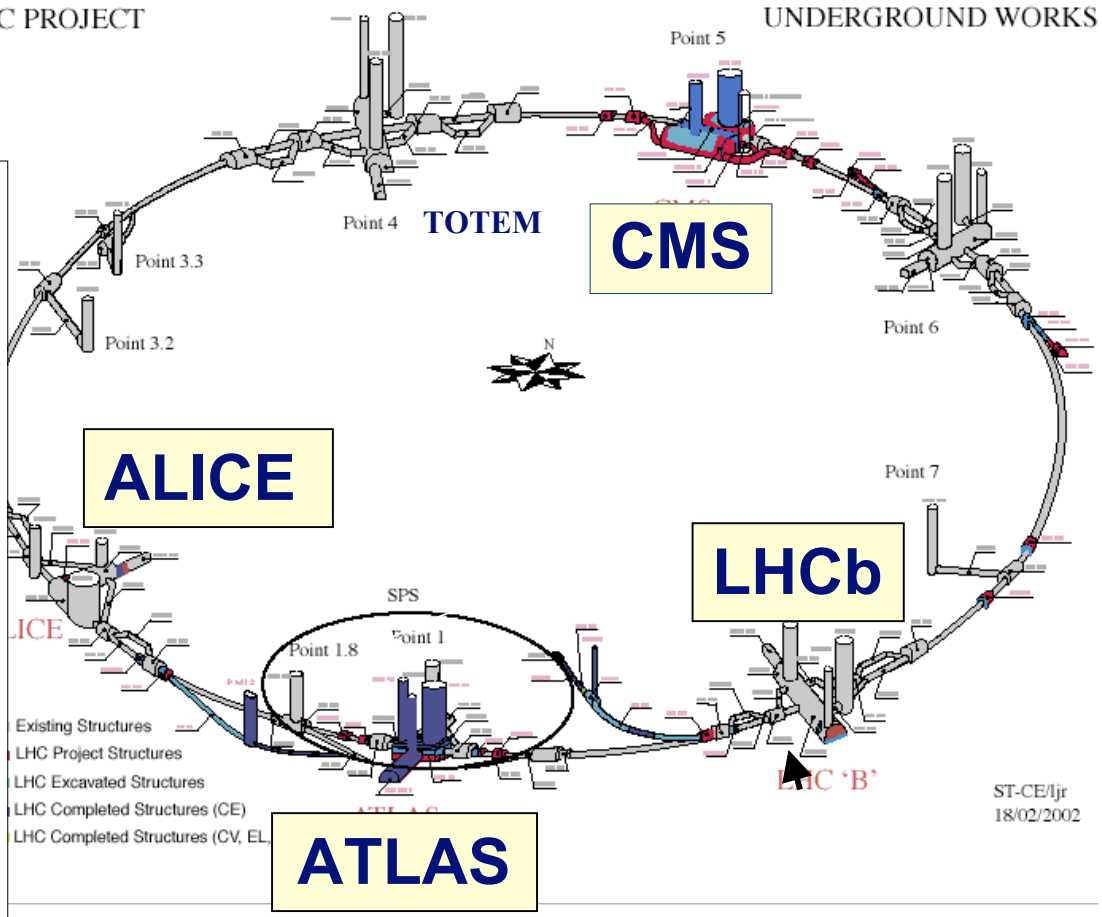
research • collaboration • scholarship

Measuring apparatus have become prohibitively expensive for a single nation to develop (NSB report, 2004)

Countries collaborating in the LHC project are Armenia, Australia, Austria, Azerbaijan Republic, Belarus, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, India, Israel, Italy, Japan, Korea, Morocco, Netherlands, Norway, Pakistan, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States, Uzbekistan

Sea Mas (200

✸ **27 km Tunnel in Switzerland & France**



E-Science facility in Sao Paulo

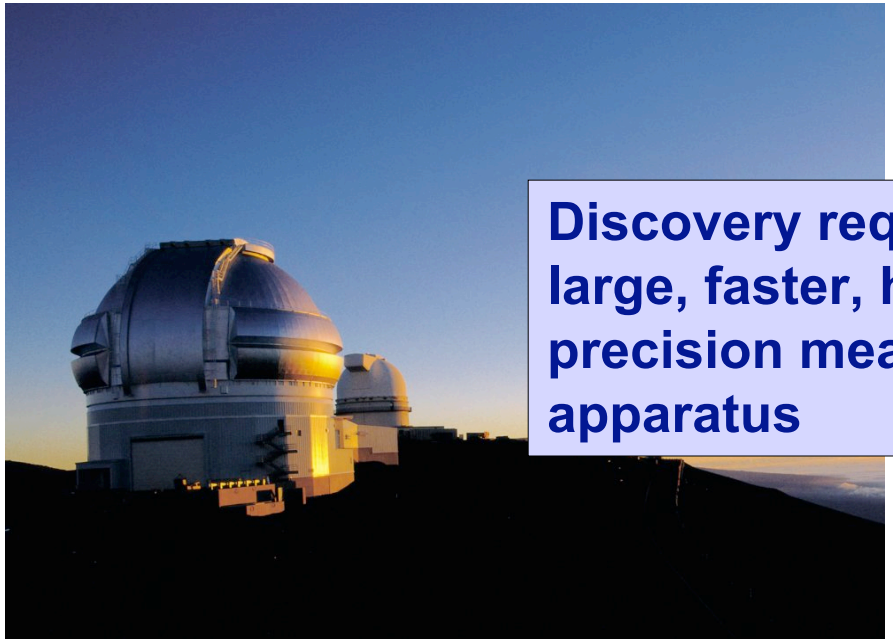
CIARA
research • collaboration • scholarship

São Paulo Regional Analysis Center

- Funded by FAPESP
- Implemented in 3 phases

	Phase 1 (2004)	Phase 2 (2005)	Phase 3 (2006)
CPU	50	115	180
Comp. Power (GHz)	125	325	550
Storage (TB)	4	12	12

The International Gemini Observatory



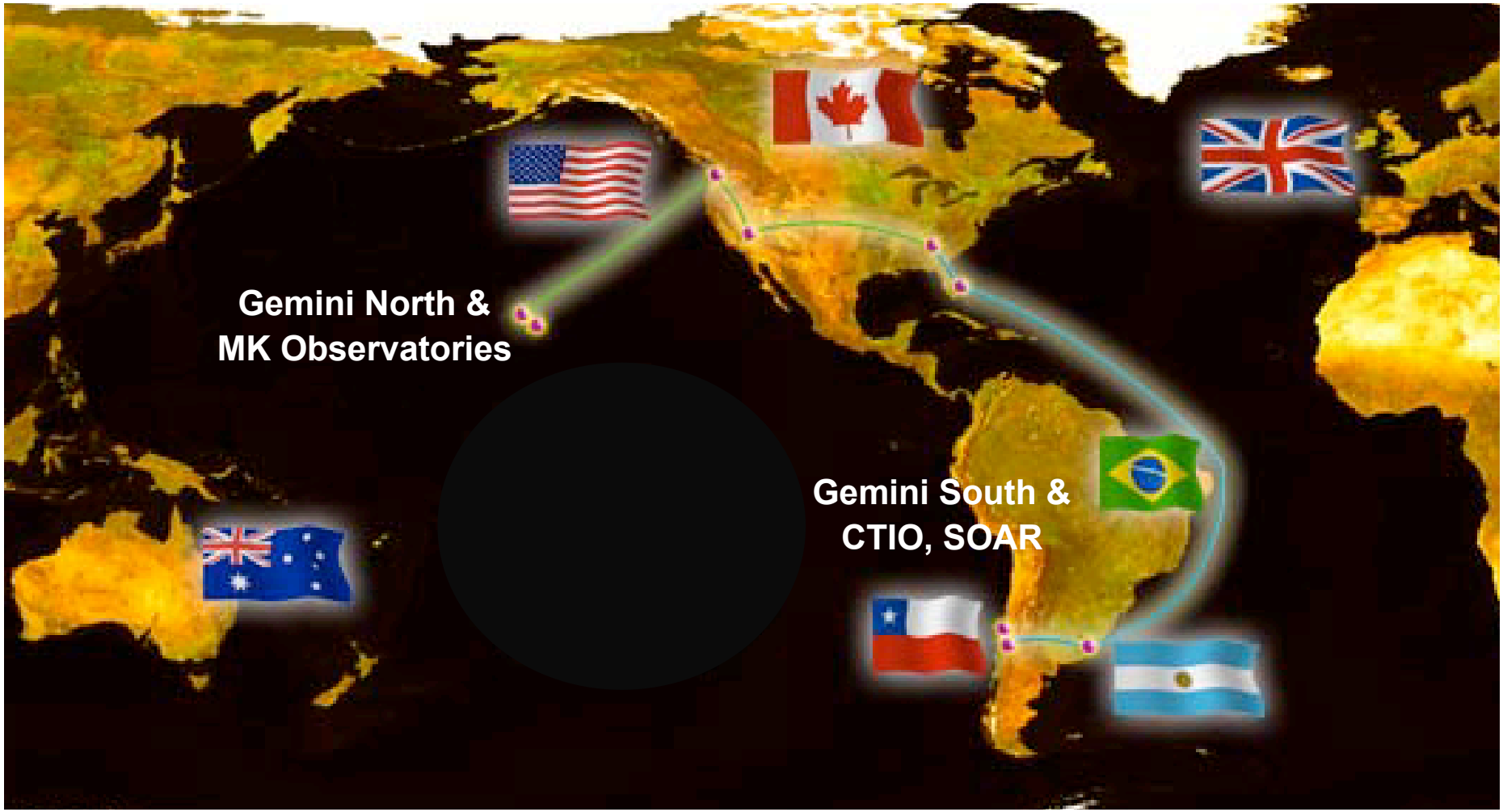
Discovery requires large, faster, higher precision measuring apparatus

Mauna Kea Hawai'i
13,700 ft

Cerro Pachón
Chile
9,000 ft

7 Nation Collaboration

CIARA
research • collaboration • scholarship

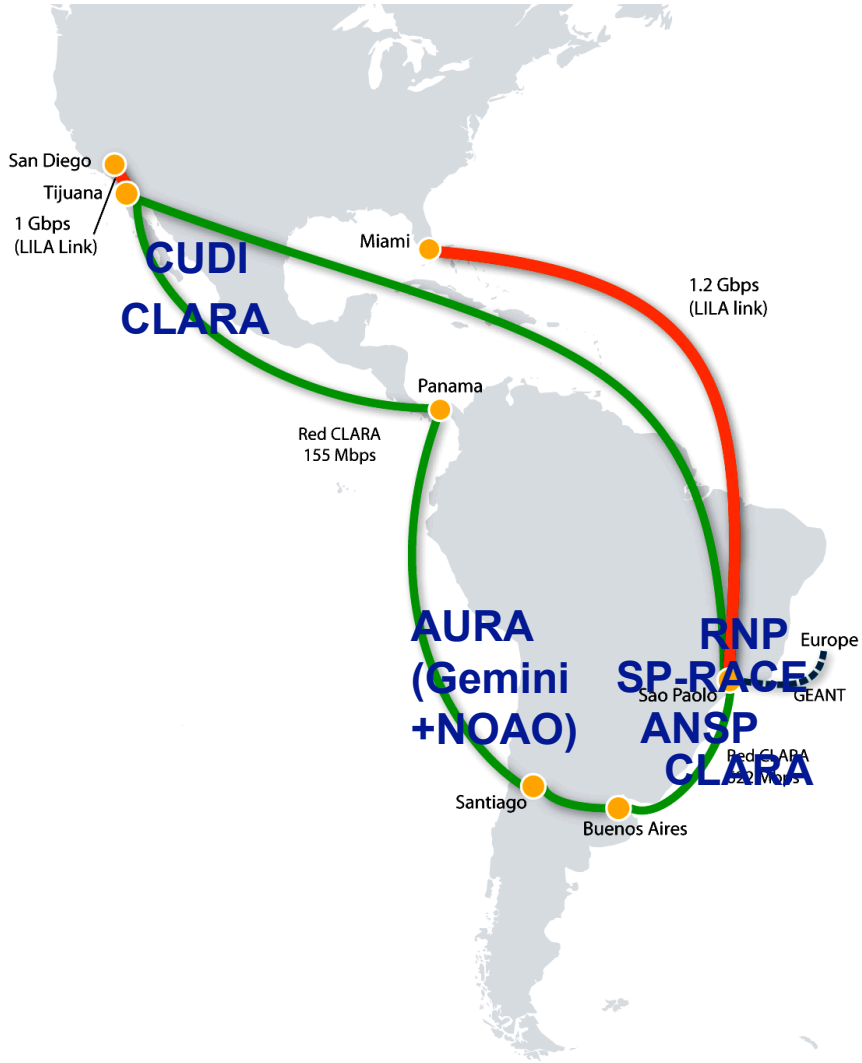


WHREN-LILA
IRNC Award 0441095

- 5-year NSF Cooperative Agreement
  - Florida International University (IRNC awardee)
  - Corporation for Education Network Initiatives in California (IRNC awardee)
  - Project support from the Academic Network of Sao Paulo (award #2003/13708-0)
  - CLARA, Latin America
  - CUDI, Mexico
  - RNP, Brazil
- Links Interconnecting Latin America (LILA) aims to Improve connectivity in the Americas through the establishment of new inter-regional links
- Western-Hemisphere Research and Education Networks (WHREN) serves as a coordinating body whose aim is to leverage participants' network resources to foster collaborative research and advance education throughout the Western Hemisphere

Links Interconnecting Latin America

- Miami - Sao Paulo link: 1.2Gbps by year end, evolving to 2.5Gbps
- Connects State of Sao Paulo academic network (ANSP) and Exchange Point, regional network (CLARA), Brazilian NREN (RNP), other international networks
- San Diego - Tijuana link: operating at 1 Gbps, providing dedicated GigE links to regional network (CLARA) and Mexican NREN (CUDI)
- East and west coast connectivity to I2 Abilene and other US and global R&E networks



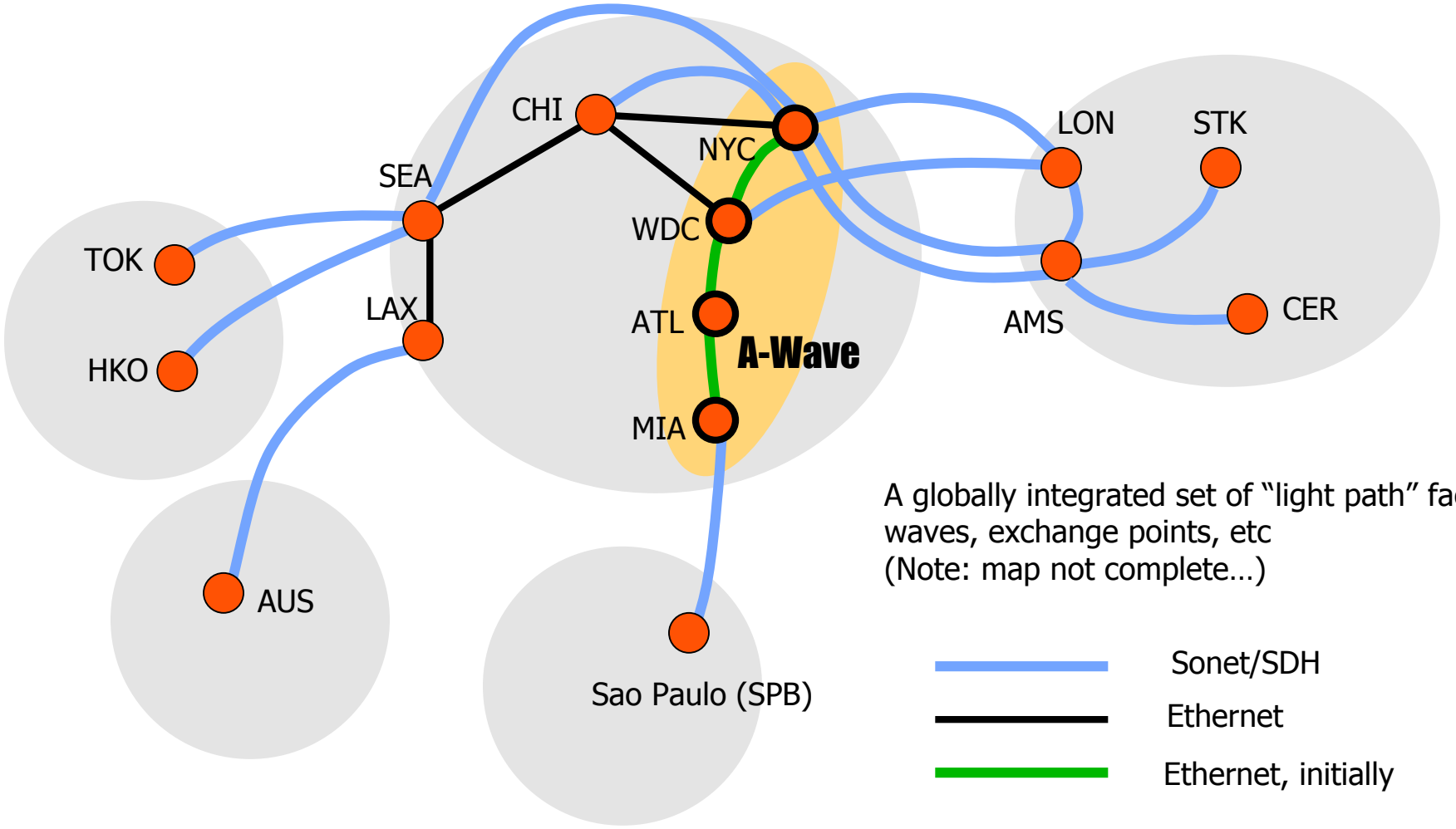
http://www.whren-lila.net

AtlanticWave

- AtlanticWave is an International Peering Fabric
  - US, Canada, Europe, South America
  - Distributed IP peering points and add/drops in:
    - NYC, WDC, ATL, MIA, SPB
- SURA, FIU-AMPATH, IEEAF, MAX, SoX, MANLAN, and in partnership with the Academic Networks of Sao Paulo (ANSP) are combining efforts to establish AtlanticWave
- A-Wave is an integral component of the NSF IRNC WHREN-LILA project to create an open distributed exchange and transport service along the Atlantic rim
- Complements the PacificWave distributed peering facility on the Pacific rim

The Global Picture

AtlanticWave
NEW YORK WASHINGTON ATLANTA MIAMI SAO PAULO



A globally integrated set of "light path" facilities: waves, exchange points, etc
(Note: map not complete…)

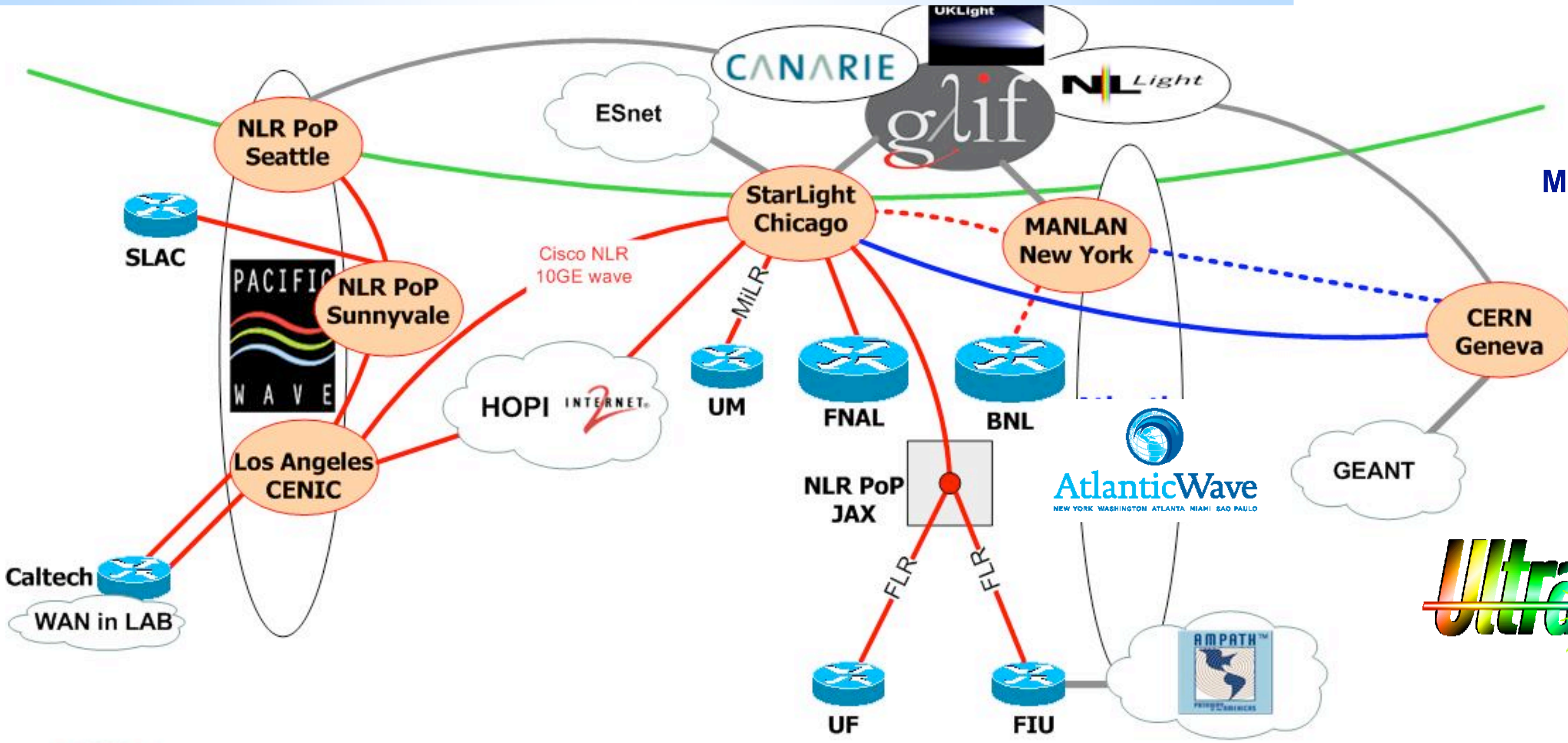
Sonet/SDH
Ethernet
Ethernet, initially

UltraLight: Advanced Network Services for Data Intensive HEP Applications

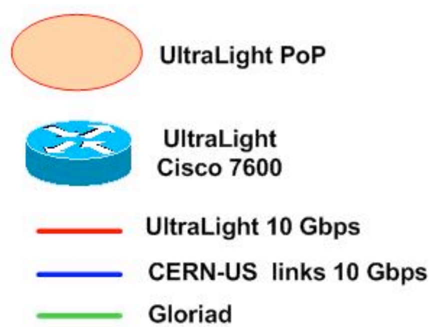
CIARA
research • collaboration • scholarship

NSF

MPS #0427110



UltraLight



- Extend and augment existing grid computing infrastructures (currently focused on CPU/storage) to inclu
- A ne … hed *dyna*
- Part … ; UERJ, USP, ANSP, RNP, GLORIAD (cn, kr, ru), GLIF
- Strong support from Cisco, CENIC, NLR, FLR

Active partnership in UltraLight offered to USP and ANSP of the Kyatera project

Center for High-Energy Physics Research and Educational Outreach (CHEPREO)

- An integrated program of research, cyberinfrastructure development, and educational outreach
  - Collaboration with FIU, Caltech, University of Florida, Florida State University, the State University of Rio de Janeiro, University of Sao Paulo
- Joint funding by NSF (MPS-0312038) and State of Sao Paulo Research Foundation (FAPESP) award #2003/13708-0

CIARA
research • collaboration • scholarship

CHEPREO
CENTER FOR HIGH ENERGY PHYSICS RESEARCH & EDUCATION OUTREACH

UNIVERSITY OF FLORIDA

Universidade do Estado do Rio de Janeiro

iVDgL

CMS Compact Muon Solenoid

NSF

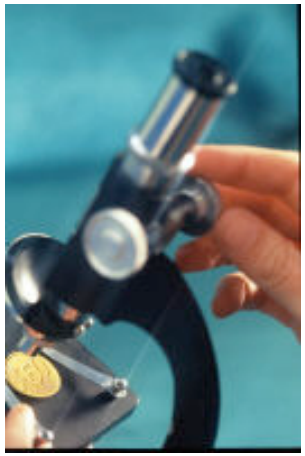
FAPESP

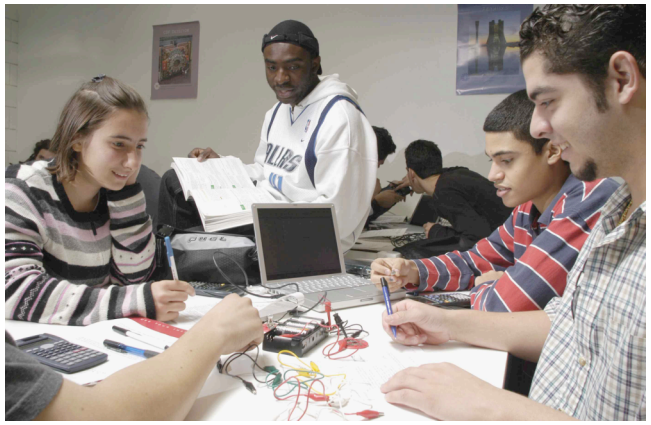
CHEPREO EDUCATION AND OUTREACH

CIARA
research • collaboration • scholarship

- Raise involvement in science and research
- High School teacher training and support
- Engage HS, Undergrad, and Grad students in active learning and mentoring
- Build collaborative communities in schools
- Motivate students to pursue careers in science
- Facilitate discovery and innovation

CHEPREO
CENTER FOR HIGH ENERGY PHYSICS RESEARCH & EDUCATION OUTREACH





cyberbridges

CI-TEAM Demonstration

By understanding Research & Education Cyber Infrastructure, we will bridge the divide between IT and the Sciences

U.S. NSF Award # 0537464

Oct 1, 2005 - Sept 30, 2006

Heidi Alvarez, PI CIARA
Julio Ibarra, Co-PI CIARA
Chi Zhang, Co-PI CS
Eric Johnson, Co-PI CS

4 Science & Engineering Graduate Student Fellowships

- **Research Stipend**
- **Tuition for Spring and Summer 2006**
- ***CIARA IT Science Certificate***
- **Collaborative publication & conference participation**

Project Plan

Spring 2006:13-week consecutive courses

- Network Engineering with Eric Johnson
- Grids/Distributed Computing with Chi Zhang

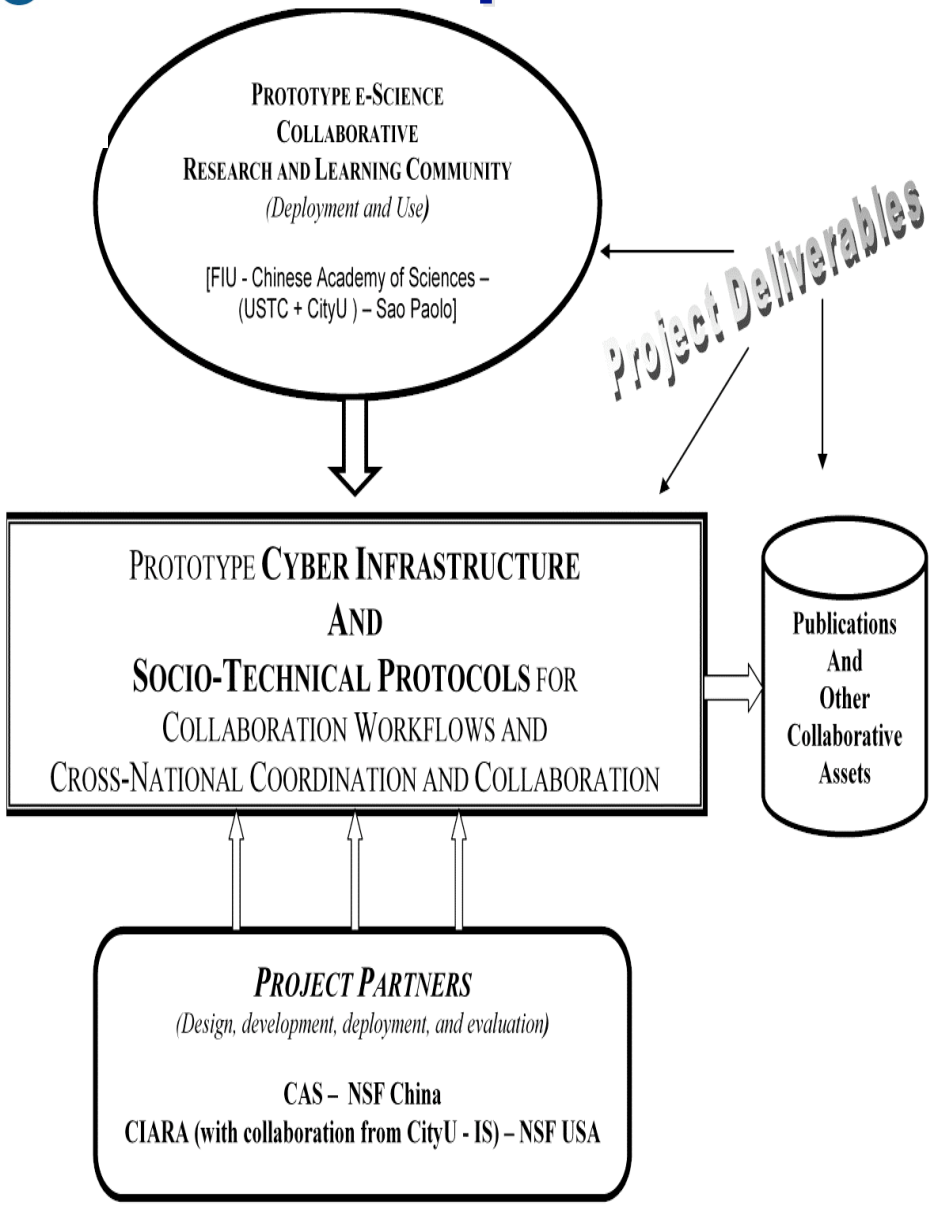
Summer 2006: Independent Study Supervised by Alvarez & Ibarra in concert with science and engineering faculty advisors

- Collaborative multidisciplinary research project using CI
- Deliverable: publish and present results at a conference

cyberbridges

Next Steps

- Expand program to multiple institutions, more students
- Global CyberBridges
  - A Model Global Collaboration Infrastructure for e-Science between US, Brazil and China
  - This model infrastructure could be developed through a partnership between CIARA, FAPESP and CAS (The Chinese Academy of Sciences)



CIARA
research • collaboration • scholarship

Thank You

Email: julio@fiu.edu

Web: www.ciara.fiu.edu

Phone: 305-348-4105