AMPATH™: Pathway of the Americas

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Information Technologies and Telecommunications as key elements for the Development of a Knowledge Society in the Caribbean

Julio Ibarra
Principal Investigator and Director
julio@fiu.edu
www.ampath.fiu.edu

List of Topics

- What is Internet2?
- About Florida International University and AMPATH
- Research and Education networks in the Caribbean
- Advanced Network Infrastructure
- Advanced Applications
- Working Groups and Workshops

What is Internet2?

Internet2 is a consortium being led by 202 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet.

Internet2 is recreating the partnership among academia, industry and government that fostered today´s Internet in its infancy.

About Florida International University

- A Top, Urban, Public, Doctoral-Research Extensive University
- 182 bachelor's, master's and doctoral degree programs and conducts cutting-edge basic and applied research in a broad spectrum of fields
- Currently, FIU has more than 34,000 students, 1,100 full-time faculty, and 95,000 alumni, making it the largest university in South Florida and placing it among the nation's 25 largest colleges and universities.

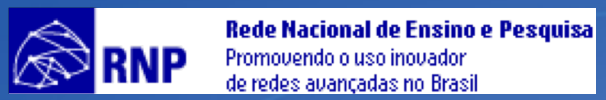
http://www.fiu.edu/docs/facts_info_stats.htm

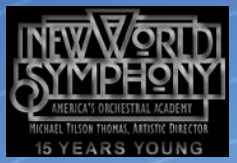
About AMPATH™

- Launched in March 2000 as a project led by Florida International University (FIU), with industry support from Global Crossing (GX), Cisco Systems, Lucent Technologies, Juniper Networks and Terremark Worldwide
- Enables wide-bandwidth digital communications between the Abilene network and 10 National Research and Education Networks (NRNs) in South and Central America, the Caribbean and Mexico
- Provides connectivity to US research programs in the region
- AMPATH is a project of FIU and the National Science Foundation's Advanced Networking Infrastructure & Research (ANIR) Division

AMPATH Participants

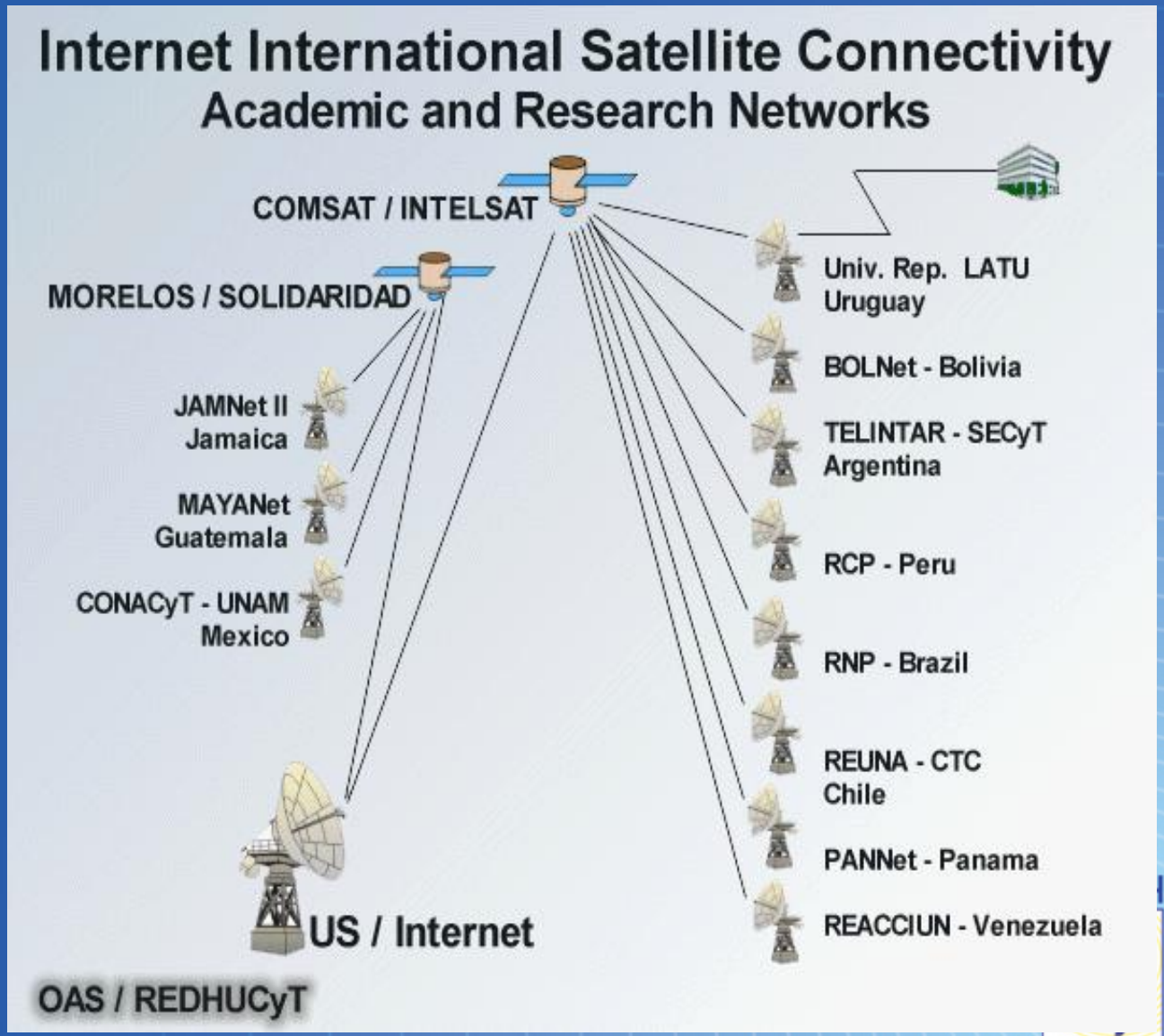
- Argentina – RETINA2
- Brazil – RNP and FAPESP
- Chile – REUNA
- Venezuela – REACCIUN2
- Gemini South optical observatory
- University of Puerto Rico
- Arecibo Radio Observatory
- New World Symphony





History of Research and Education Networking in the Caribbean

- University of Puerto Rico, in collaboration with the OAS and other Caribbean universities, provided basic support to implement email exchange
- The first full interactive Internet PoP was established at the University of West Indies in Jamaica
- Other universities and projects participating from the Sir Arthur Lewis Community College in St. Lucia and the College of the Bahamas; the Dominican Republic's academic backbone, Red Universitaria Dominicana Academica y Cientifica



Advanced Network Infrastructure

- Advanced Network Infrastructure in the Caribbean
  - ARCOS
  - Global Crossing
  - Emergia
  - NAP Of The Americas
  - Puerto Rico
- Internet2

Americas Region Caribbean Optical-ring System (ARCOS)

- ARCOS connects the United States with the Bahamas, Turks & Caicos, Dominican Republic, Puerto Rico, Curaçao, Venezuela, Colombia, Panama, Costa Rica, Nicaragua, Honduras, Guatemala, Belize and Mexico

- The ARCOS submarine cable has a system capacity of 4 Tbps

- ARCOS is a consortium cable with 86.5% of it owned by New World Networks

Global Crossing

- Landings in the United States, Venezuela, Brazil, Argentina, Chile, Peru, Colombia and Panama, St. Croix
- Total system capacity is 1.28 Tbps
- Contains 8 fiber-optic segments working in a self-healing ring fashion, in the event there is a fiber cable cut

Emergia

- The Emergia cable system lands in the United States, Puerto Rico, Brazil, Argentina, Chile, Peru, Colombia and Guatemala
- The system capacity is 1.92 Tbps
- Telefonica's Emergia cable system is also a self-healing ring that is designed to survive a cable cut

NAP Of The Americas

- Fifth Tier-1 NAP
- Strategically located to serve Latin America, the Caribbean, Southern Europe and Africa
- Close to major carrier POPs and 9 worldwide undersea cable landings

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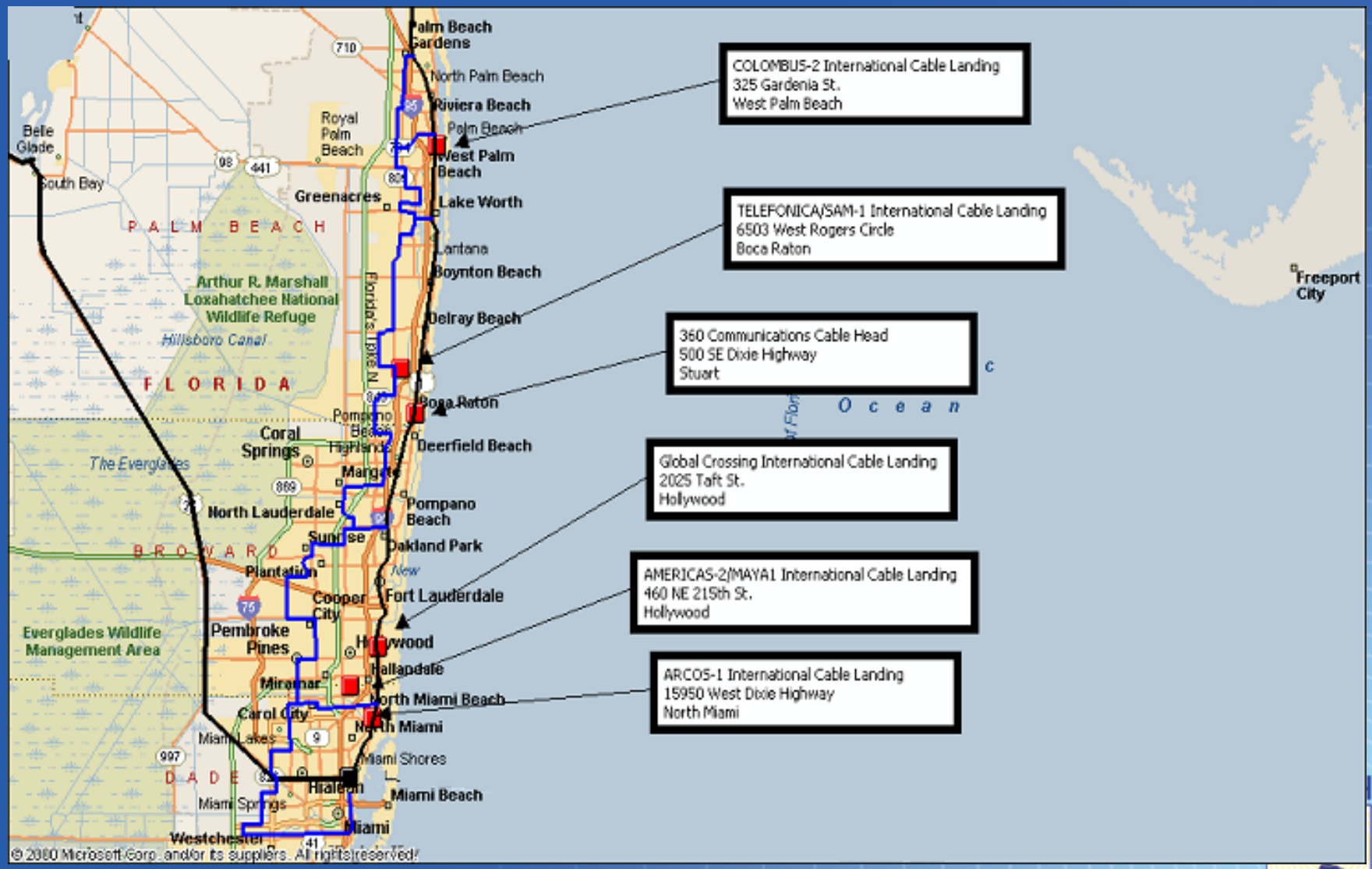
International Cable Landings

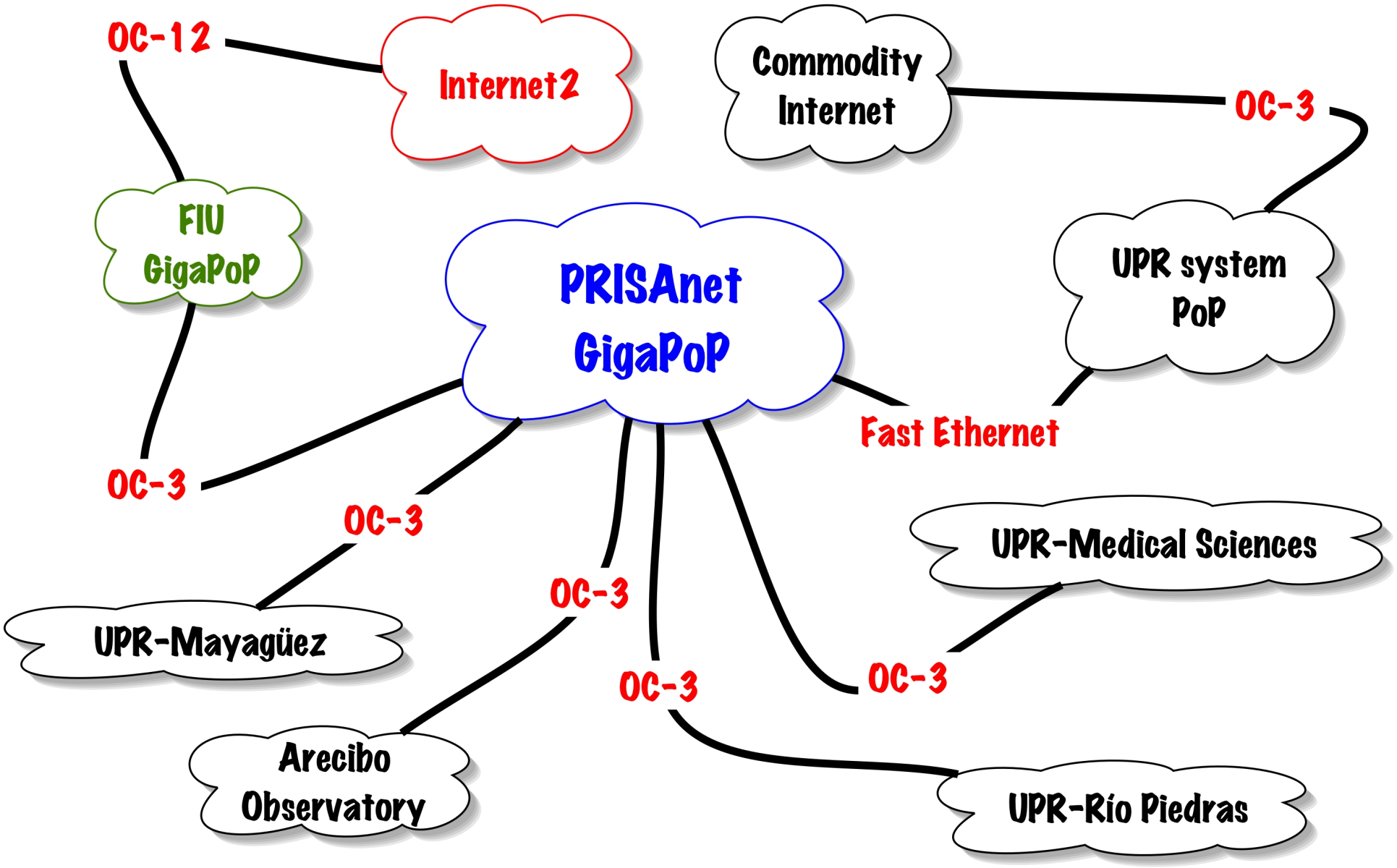


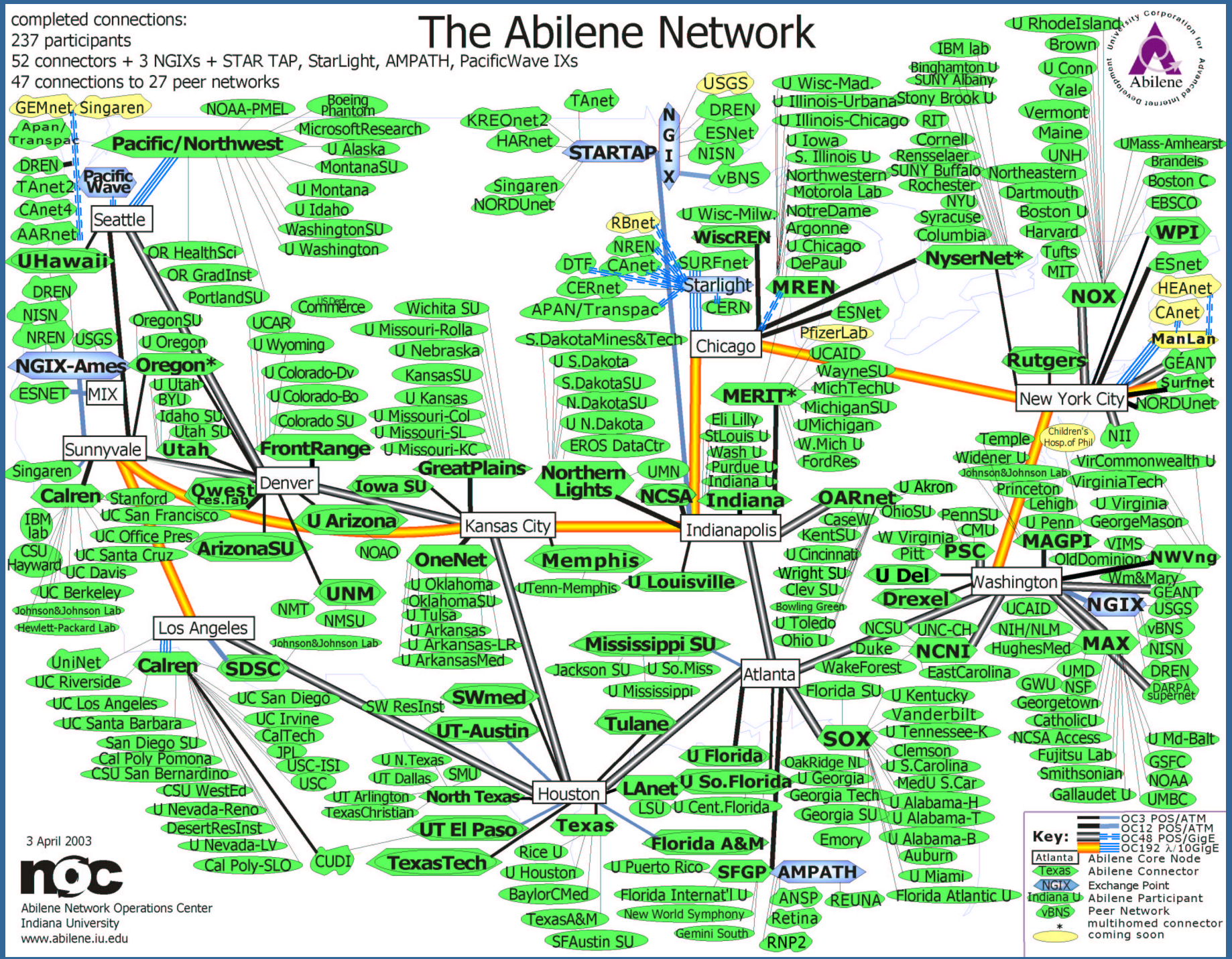
Undersea Optical Infrastructure Summary

Submarine Fiber-Optic Cable System	Total Bandwidth Capacity (GB)
Americas 1	.560
Americas II	2.5
South American Crossing	1,280
Columbus II	.560
Columbus III	2.5
Telefonica's Emergia	1,920
ARCOS	960
Maya-1	60
360 Americas	10

The total aggregate bandwidth capacity Latin America and Caribbean region is estimated at 4,236 GB

Puerto Rico Internet2 Services Alliance (PRISAnet) & Internet2 Connections

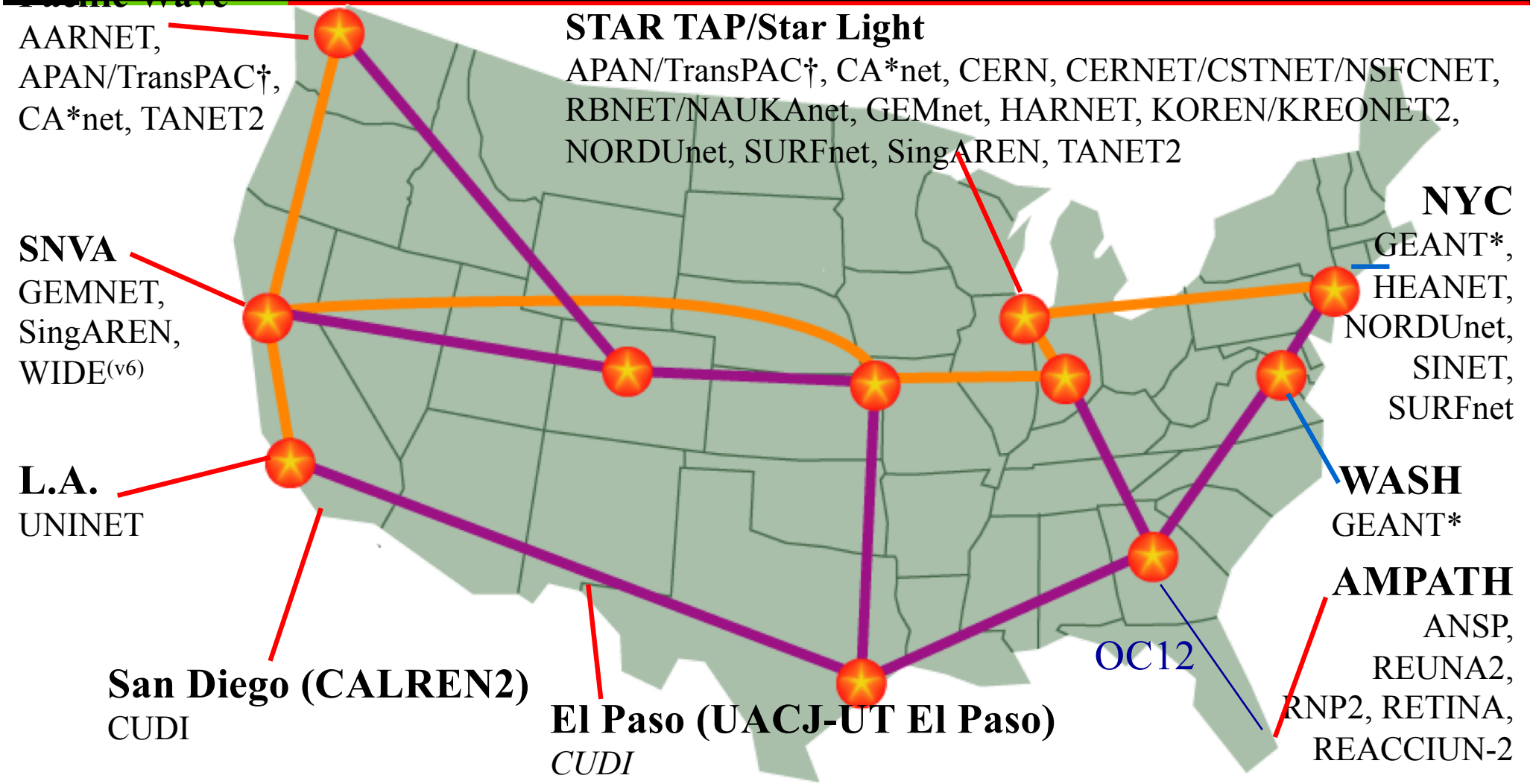




http://www.abilene.iu.edu/images/logical.pdf

Last updated: 21 April 2003

Abilene International Peering (May 2003)



•ARNES, ACONET, BELNET, CARNET, CERN, CESnet, CYNET, DFN, EENet, GARR, GRNET, HEANET, IUCC, JANET, LATNET, LITNET, NORDUNET, RENATER, RESTENA, SWITCH, HUNGARNET, GARR-B, POL-34, RCST, RedIRIS, SANET, SURFNET

•† WIDE/JGN, IMnet, CERNet/CSTnet,/NSFCNET, KOREN/KREONET2, PREGINET, SingAREN, TANET2, ThaiSARN

Last updated: 23 April 2003

Networks reachable via Abilene – by country

Europe-Middle East

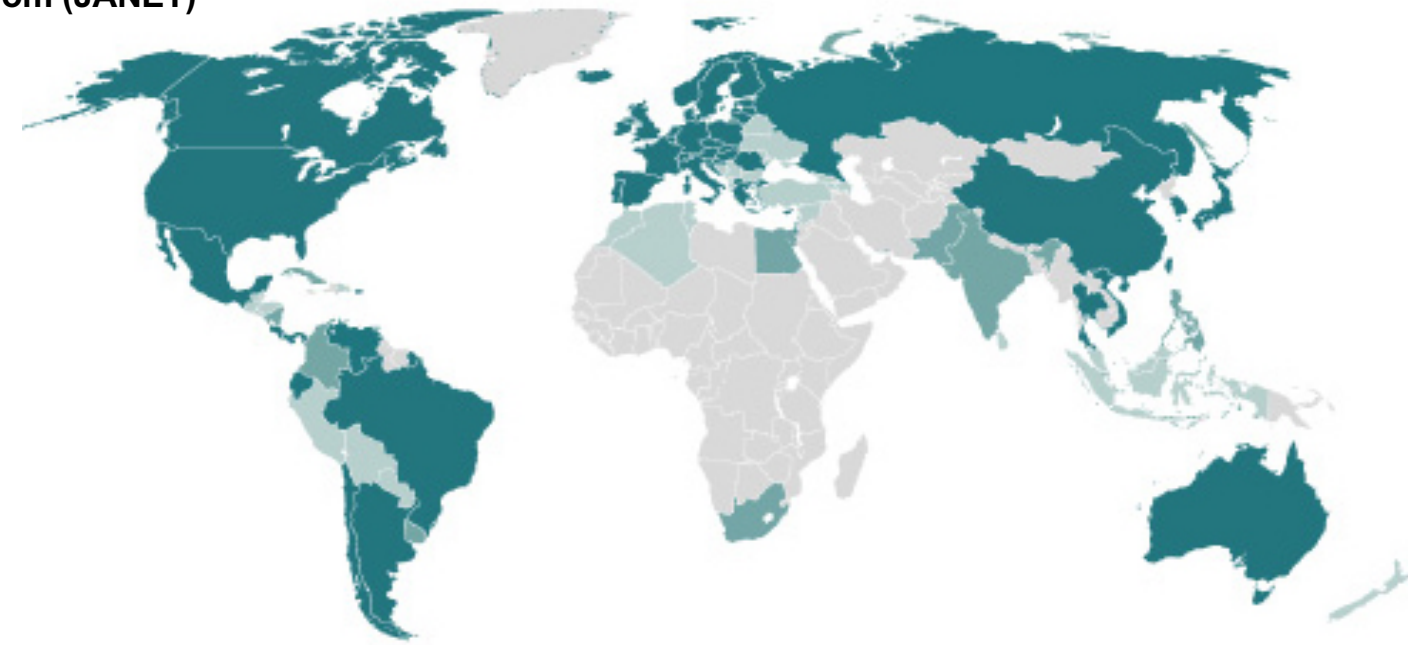
Austria (ACOnet)
Belgium (BELnet)
Croatia (CARnet)
Czech Rep. (CESnet)
Cyprus (Cynet)
Denmark (UNI-C)
Estonia (ESnet)
Finland (FUnet)
France (RENATER)
Germany (G-Win)
Greece (GRnet)
Hungary (HUNGARnet)
Iceland (ISnet)
Ireland (HEANET)
Israel (IUCC)
Italy (GARR)
Latvia (LATNET)
Lithuania (LITNET)
Luxembourg (RESTENA)
Netherlands (SURFnet)
Norway (UNINETT)
Poland (PCSS)
Portugal (FCCN)
Romania (RNC)
Russia (RIPN)
Slovakia (SANET)
Slovenia (ARNES)
Spain (RedIris)
Sweden (SUNET)
Switzerland (SWITCH)
United Kingdom (JANET)
*CERN

Asia-Pacific

Australia (AARNET)
China (CERNET, CSTNET, NSFCNET)
Hong Kong (HARNET)
Japan (SINET, WIDE, IMNET, JGN)
Korea (KOREN, KREONET2)
Singapore (SingAREN)
Philippines (PREGINET)
Taiwan (TANET2)
Thailand (UNINET, ThaiSARN)

Americas

Argentina (RETINA)
Brazil (RNP2/ANSP)
Canada (CA*net)
Chile (REUNA)
Mexico (CUDI)
United States (Abilene, vBNS)



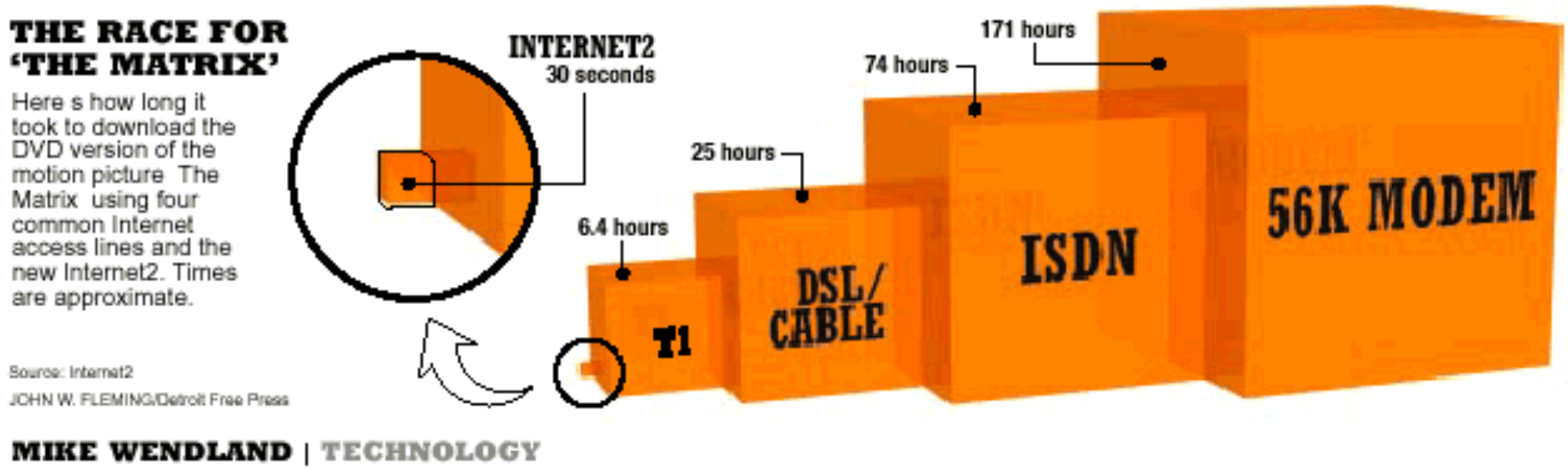
Internet2 Network Infrastructure

Backbones operate at 2.4 Gbps (OC48) to 10 Gbps (OC192) capacity today

GigaPoPs provide regional high-performance aggregation points

Local campus networks provide 100 Mbps to the desktop

Download of "The Matrix" DVD
(Comparison of the Internet2 Land Speed Record)



Advanced Applications

Distributed computation

Virtual laboratories

Digital libraries

Distributed learning

Digital video

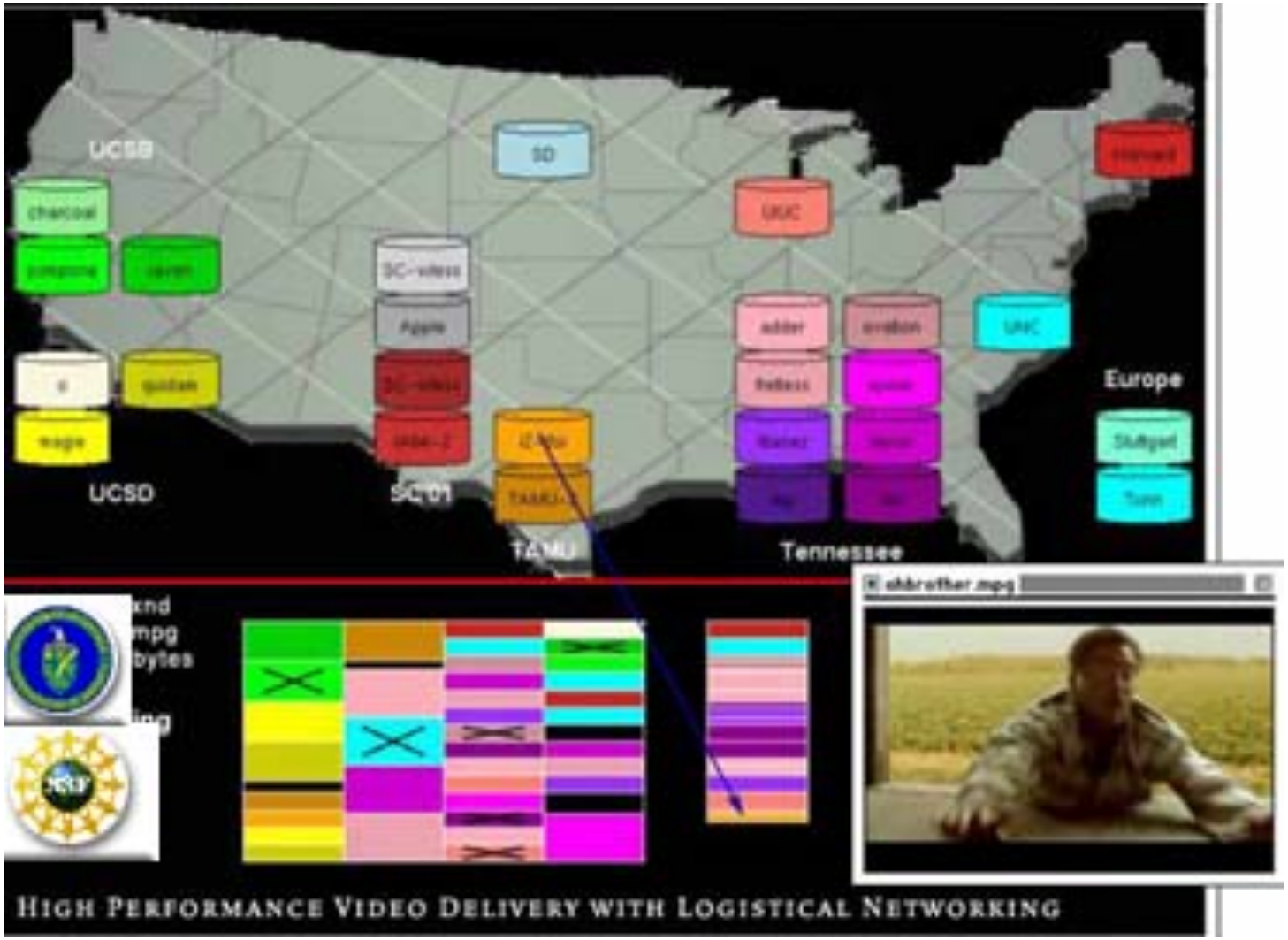
Tele-immersion

All of the above in combination

http://www.internet2.edu/info/infokit.html

http://apps.internet2.edu/

High Performance Video Delivery with Logistical Networking

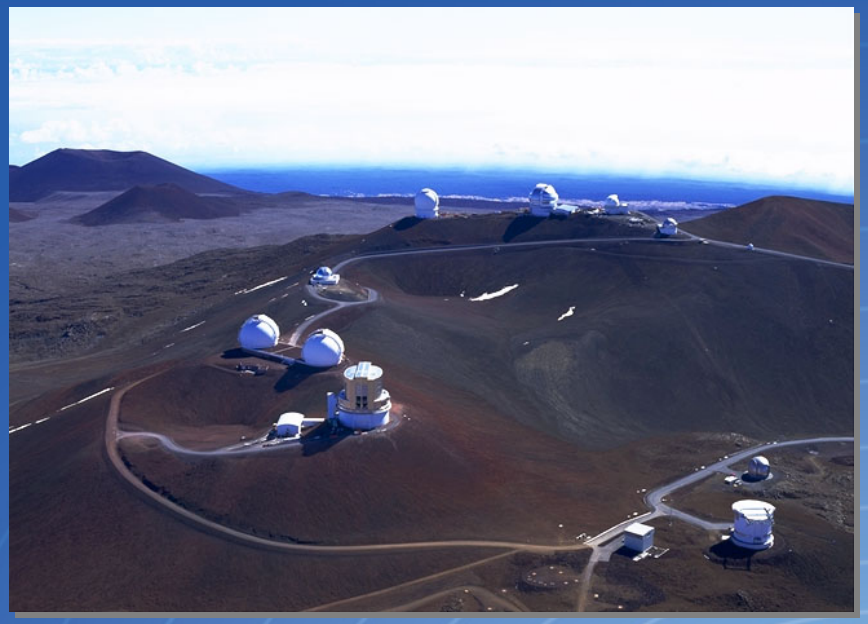


World-class Scientific Instruments

Gemini-South Optical Observatory

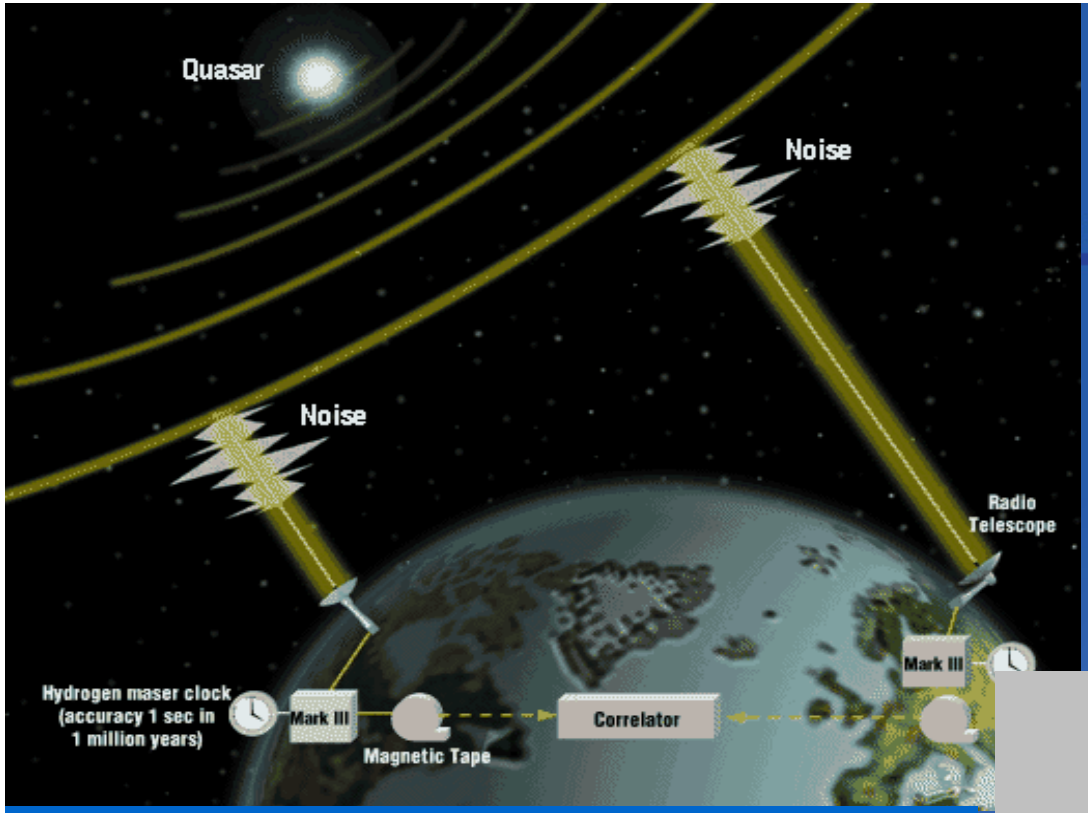
NRAO telescopes

La Serrena, Chile



Arecibo Radio Antenna, Puerto Rico

University of Puerto Rico



The Very-Long Baseline Interferometry (VLBI) Technique

The Global VLBI Array

(up to ~20 stations can be used simultaneously)

ASTRONOMY

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

GEODESY

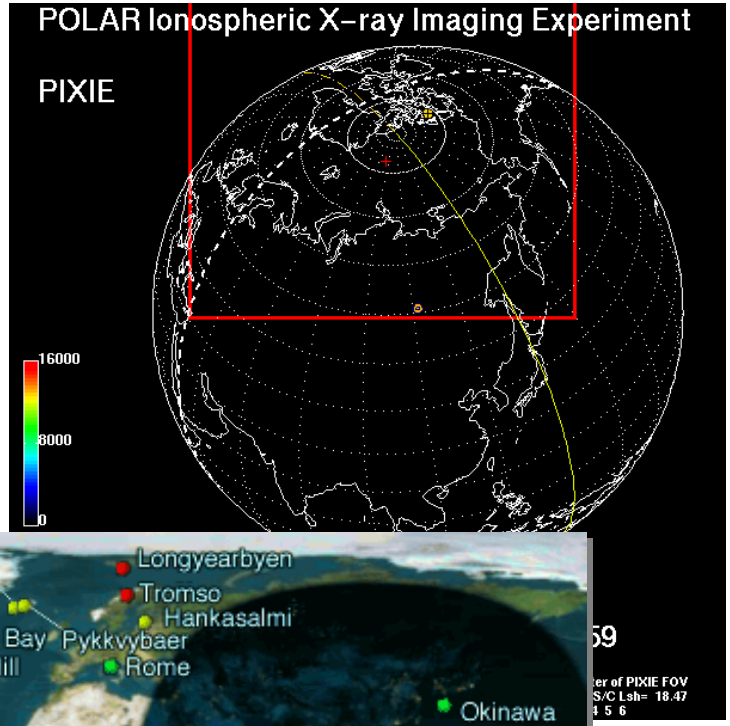
- Highest precision (few mm) technique available for global tectonic measurements
- Highest spatial and time resolution of Earth's motion in space for the study of Earth's interior
  - •Earth-rotation measurements important for military/civilian navigation
  - •Fundamental calibration for GPS constellation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

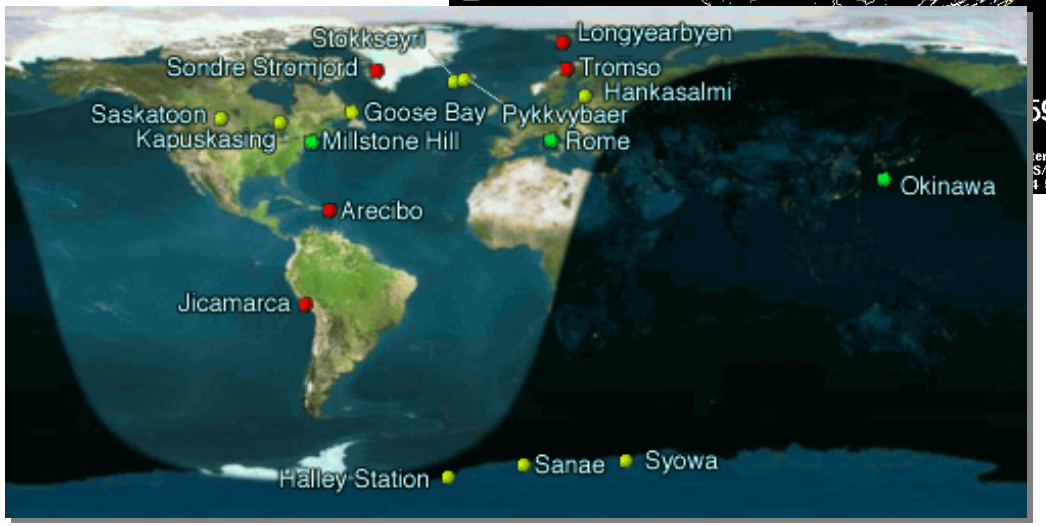
Virtual Laboratories

Space Physics & Aeronomy Research Collaboratory (SPARC)

University of Michigan

NSF



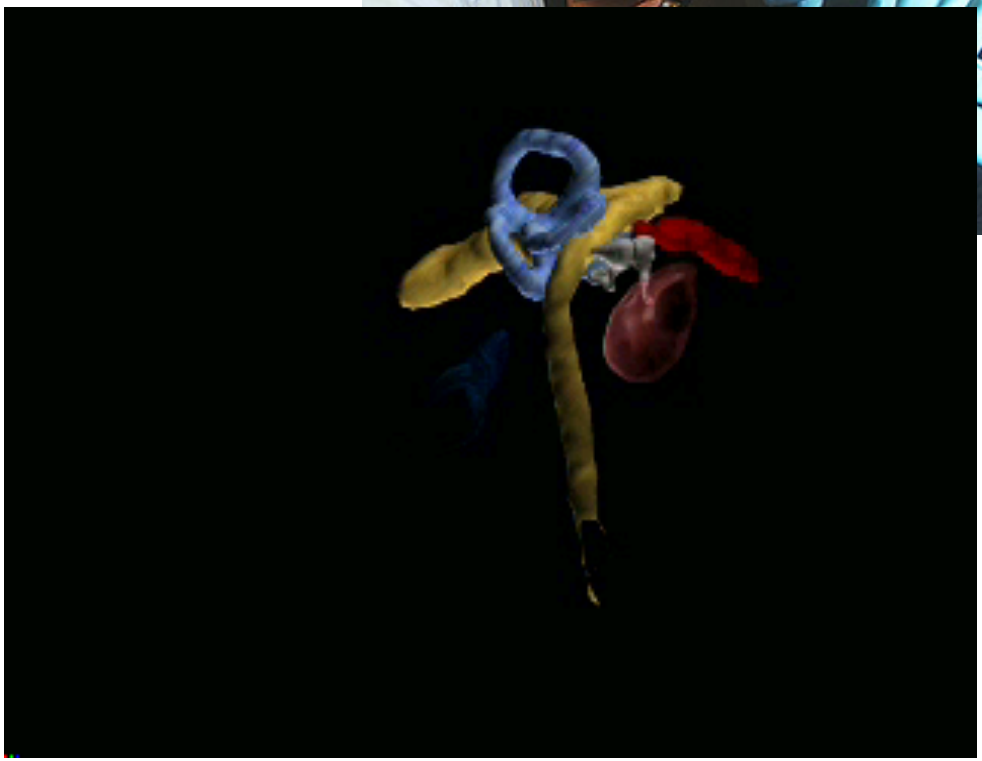


Tele-immersion

Shared virtual reality

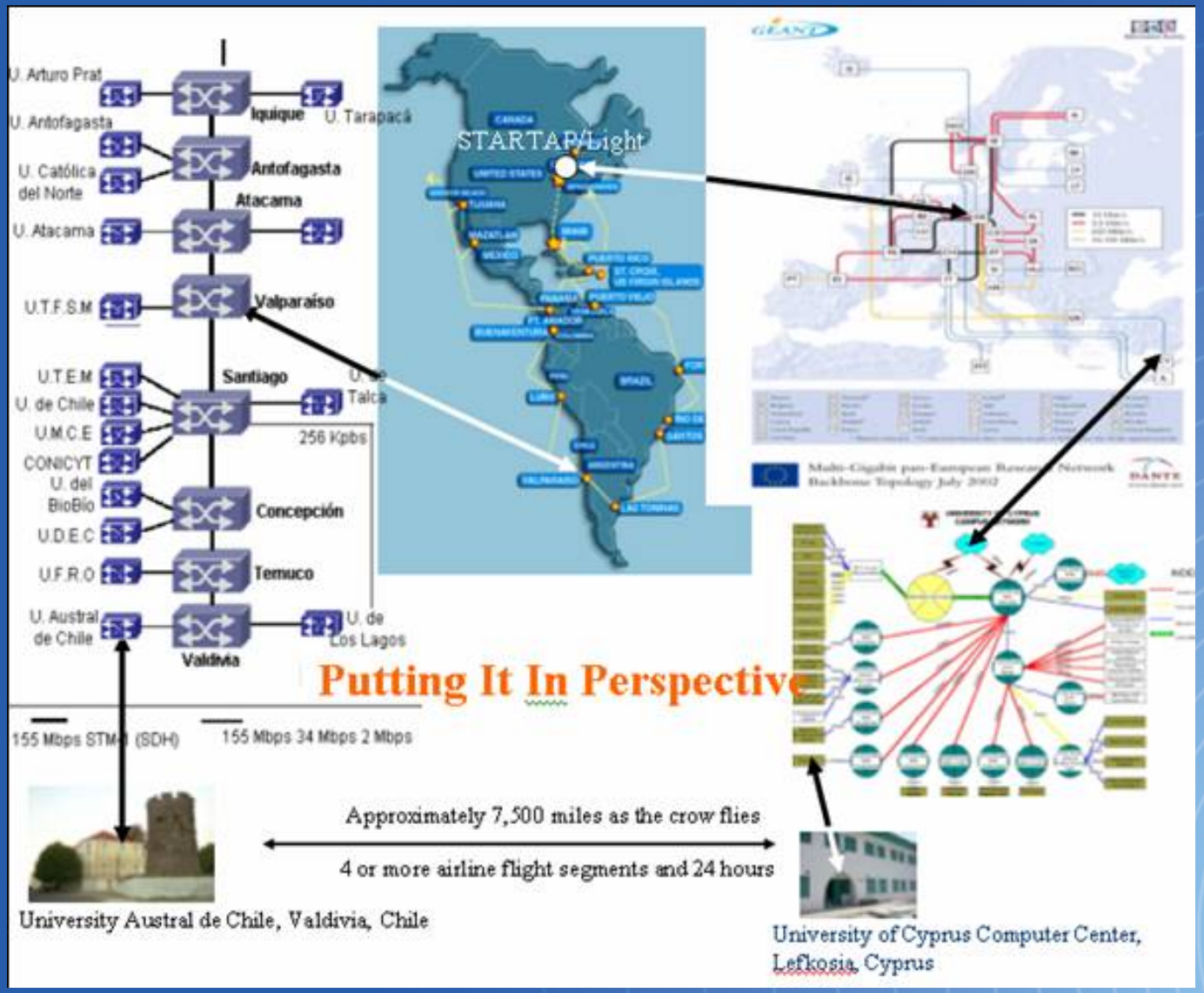
University of Illinois at Chicago

Virtual
Temporal
Bone



Tele-cubicles and the CAVE

Global Connectivity



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Classroom-to-Classroom Connectivity

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Working Groups

- AMPATH Working Groups
  - Astronomy
  - High-Energy Nuclear Physics
  - Digital Data Collaboration
  - Atmospheric and Oceanographic
  - http://www.ampath.fiu.edu/wg/AMPATH_WGs.htm
- Internet2 Working Groups
  - http://www.internet2.edu/working-groups.html

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Thank You

AMPATH: Julio Ibarra, Heidi Alvarez

Email: ampath@fiu.edu

Web: www.ampath.fiu.edu

Phone: 305-348-4105

Internet2

Heather Boyles, heather@internet2.edu

Ana Preston, apreston@internet2.edu

University of Puerto Rico

Dr. Guy Cormier

guy@hpcf.upr.edu

(787)-753-1653

http://www.hpcf.upr.edu