

Advanced Internet Connectivity in the Americas: AmericasPATH (AMPATH)



Florida International University
South Florida GigaPOP
November 3, 2000
San Antonio, Texas



AMPATH

Project Mission

*To Serve as the Pathway
for Research and
Education Networking in
the Americas and to the
World.*



The AMPATH Project

- The AMPATH project is a collaboration between Florida International University and Global Crossing to interconnect the Research and Education networks in South and Central America, the Caribbean, Mexico and other international countries to Internet2, US and non-US National Research Networks.



AMPATH Project Goals

- To enable participating countries to contribute to the research and development of applications for the advancement of Internet technologies.
- To extend the Internet2 research and education community for high-performance networking to South and Central America, the Caribbean and Mexico.



More Opportunities

AMPATH can provide connectivity for other US-funded projects in the Service Area.

For example:

- Atacama Large Millimeter Array (ALMA) Project – Chile
- The Inter-American Institute for Global Change Research – Brazil
- Yale Southern Observatory – Argentina





Benefits of AMPATH

- Provides high-speed connectivity to Internet2, US and non-US NRNs at a very low cost:
 - DS3s to Miami are free (most expensive and challenging part)
 - Costs for circuits to transit networks, engineering and operations are shared among all participants.
- By working together, everyone will benefit.
- Scales well as bandwidth requirements grow.
- Leverages ability to purchase more bandwidth for the Research and Education community.



What does a Participating Country Receive?

- Each participating country receives a DS3 of capacity to the AMPATH POP in Miami, for three years, at NO COST!
- Access to the AMPATH network from a designated Global Crossing POP.
- Transit from Abilene or STAR TAP to US and non-US National Research Networks (NRNs).





AMPATH Makes It Feasible!

- Gemini benefits because the AMPATH project provides *cost-effective* infrastructure and connectivity
 - FIU operates the AMPATH POP in Miami
 - Partnerships have been established with GC, Lucent, Cisco Systems, and Abilene
 - FIU offers its leadership and expertise to the project



Participant's Responsibilities

- Each participating country is responsible for connecting its R&E networks to a designated Global Crossing POP:
 - Provision Local Loop.
 - Provide required hardware.
- Establishing connectivity to the AMPATH POP in Miami using ATM or IP.





AMPATH's Responsibilities

- Coordinate and assist participants in establishing connectivity to AMPATH.
- Provide 24x7x365 NOC services.
- Provide leadership and coordination to ensure Participants can reach desired US and non-US NRNs.
- Broker low-cost transit service to STAR TAP, Abilene or other essential transit networks.



Global Crossing™

Global Crossing's Contribution

- Global Crossing has very generously agreed to allow Florida International University and participating countries in its Service Area the use of the available capacity of its fiber network to build an international high-performance Research and Education network in the Americas.

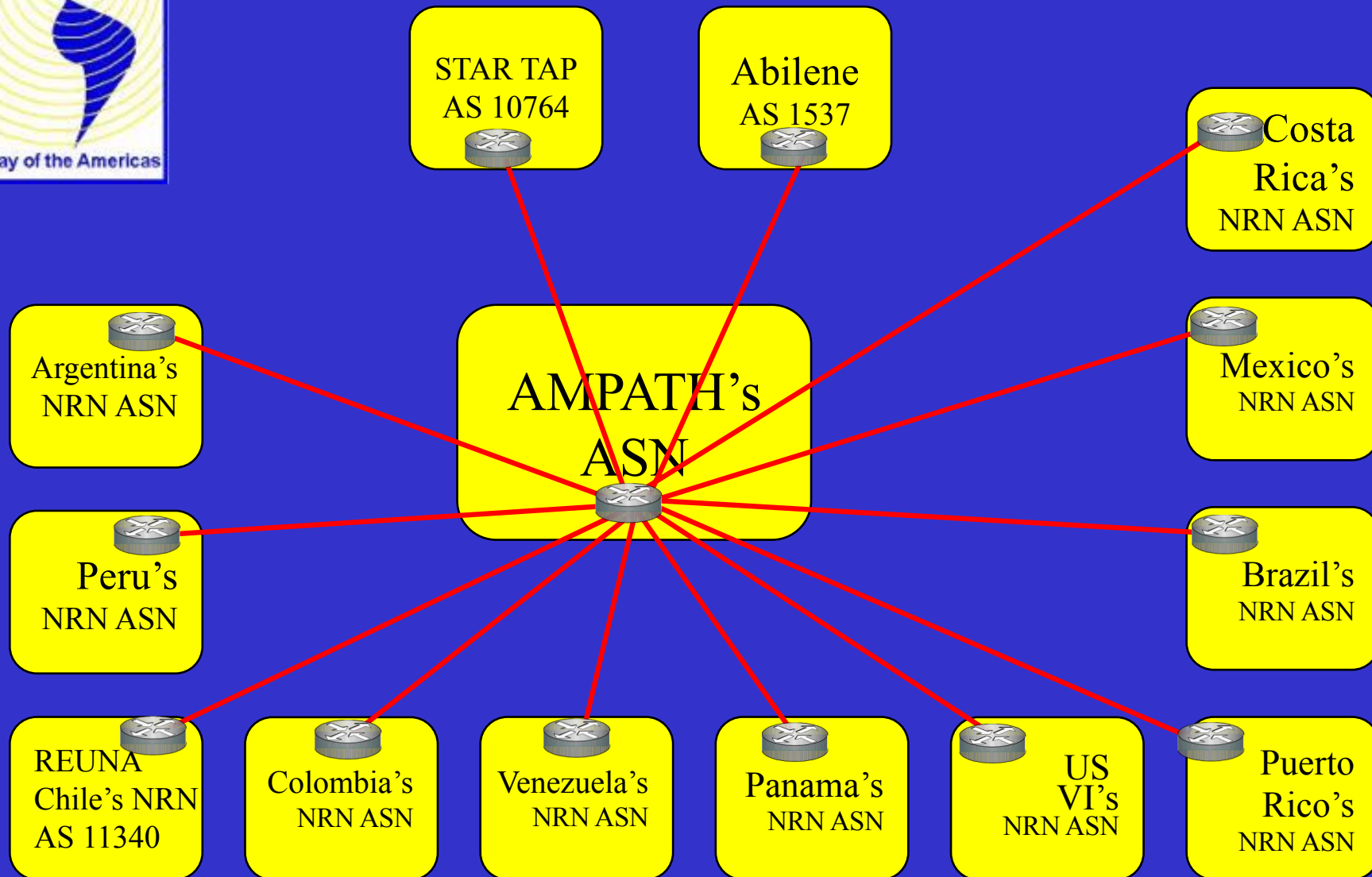
READY FOR SERVICE DATES

LIST PRICE DS-3

		Lease 1 yr. Price		Lease 3 yr. Price		Lease 5 yr. Price	
7/15/00	St. Croix	\$	500,004	\$	1,215,010	\$	1,750,014
7/15/00	Mexico City	\$	1,440,000	\$	3,499,200	\$	5,040,000
7/15/00	Panama	\$	1,000,080	\$	2,430,194	\$	3,500,280
10/15/00	Brazil	\$	1,200,000	\$	2,916,000	\$	4,200,000
10/15/00	Buenos Aires	\$	1,200,000	\$	2,916,000	\$	4,200,000
10/15/00	Caracas	\$	1,200,000	\$	2,916,000	\$	4,200,000
4/15/01	Santiago	\$	1,200,000	\$	2,916,000	\$	4,200,000
4/15/01	Lima	\$	1,200,000	\$	2,916,000	\$	4,200,000
4/15/01	Cali	\$	1,200,000	\$	2,916,000	\$	4,200,000



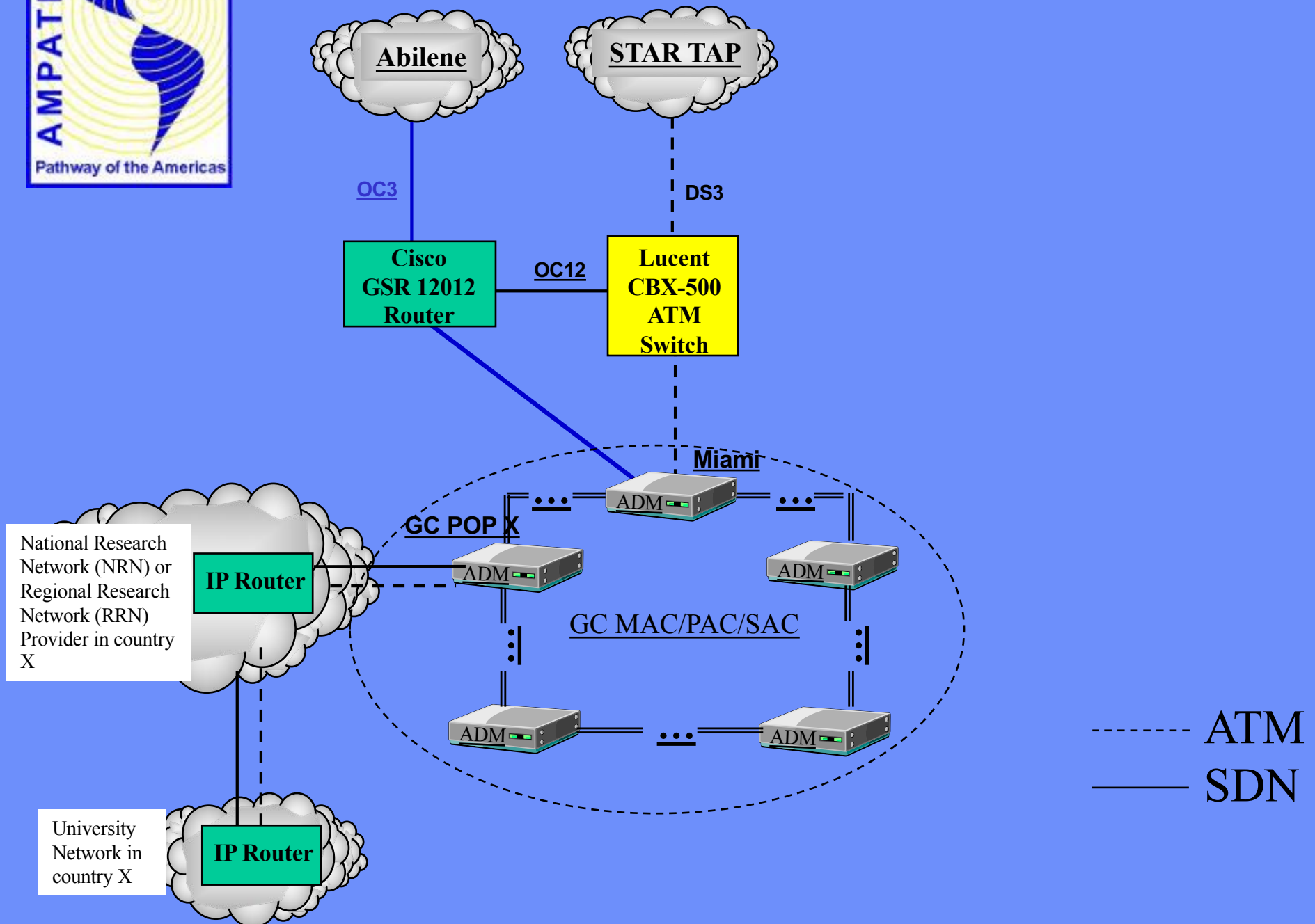
AMPATH's Connectors



NRN = National Research Network
ASN = Autonomous System Number

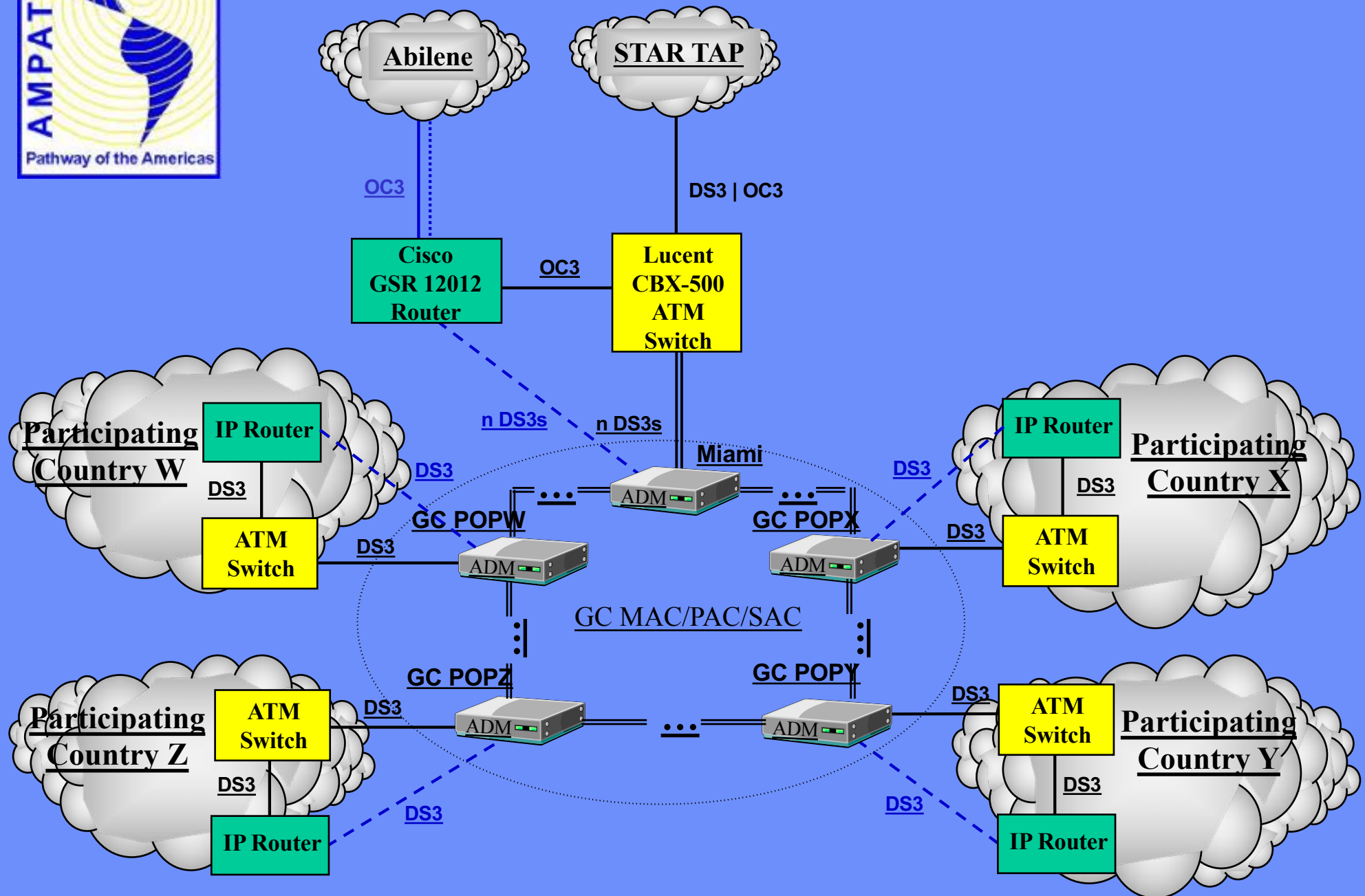


AMPATH Network





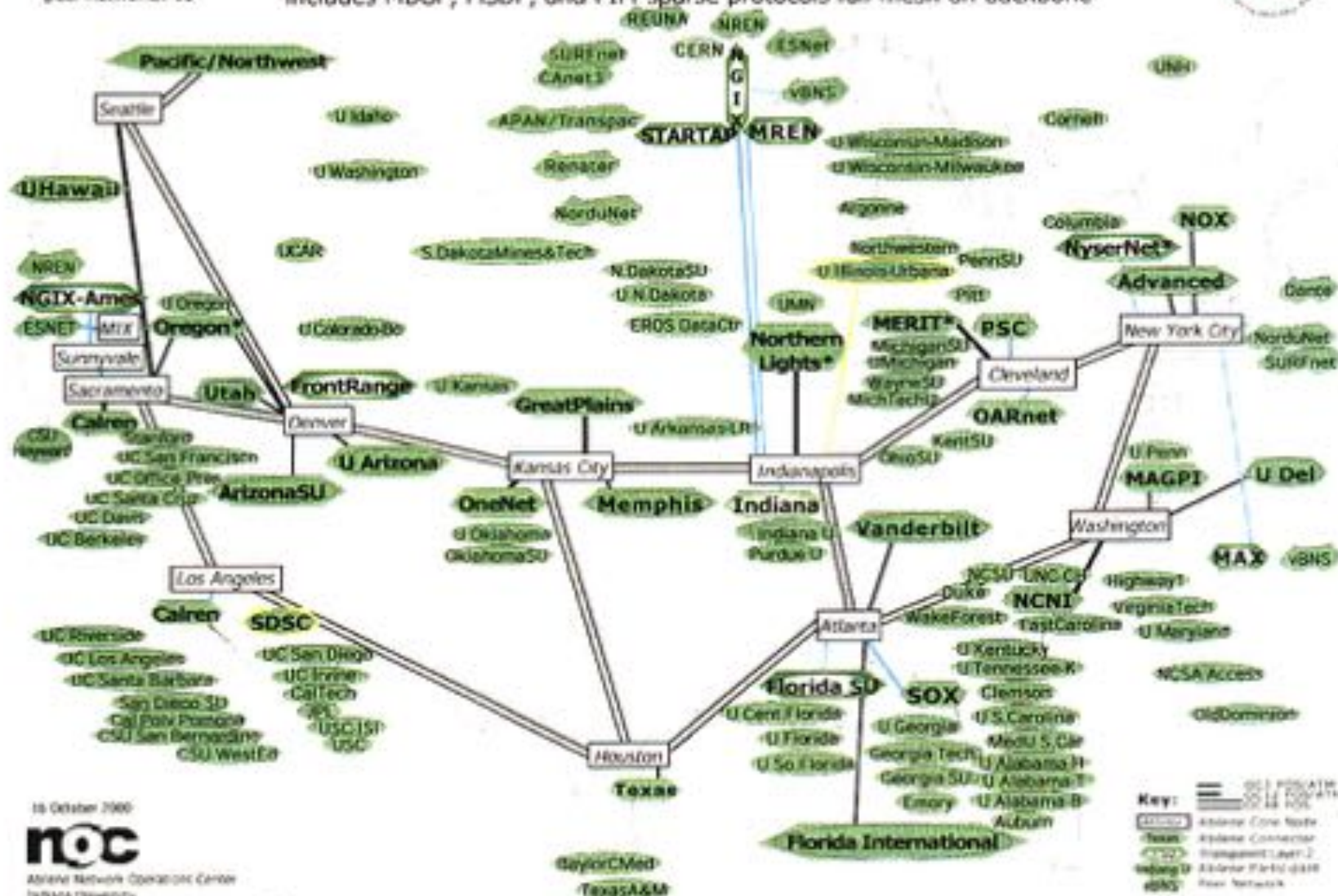
AMPATH Network



Capacity Examples

- International Private Line (IPL):
 - DS-3 (45 Mbps)
 - STM-1 (155 Mbps)
 - STM-4 (622 Mbps)
 - STM-16 (2.5 Gbps)
 - STM-64 (10 Gbps/Wavelength)
 - Collocation/Telehousing
 - IP Transit (From selected locations)
- Lease
 - IRU – Indefeasible Right of Usage (15 years)

The Abilene Network
Multicast deployment
 includes MBGP, MSDP, and PIM-sparse protocols full-mesh on backbone

116. *Callistemon* *lanceolatus***noc**

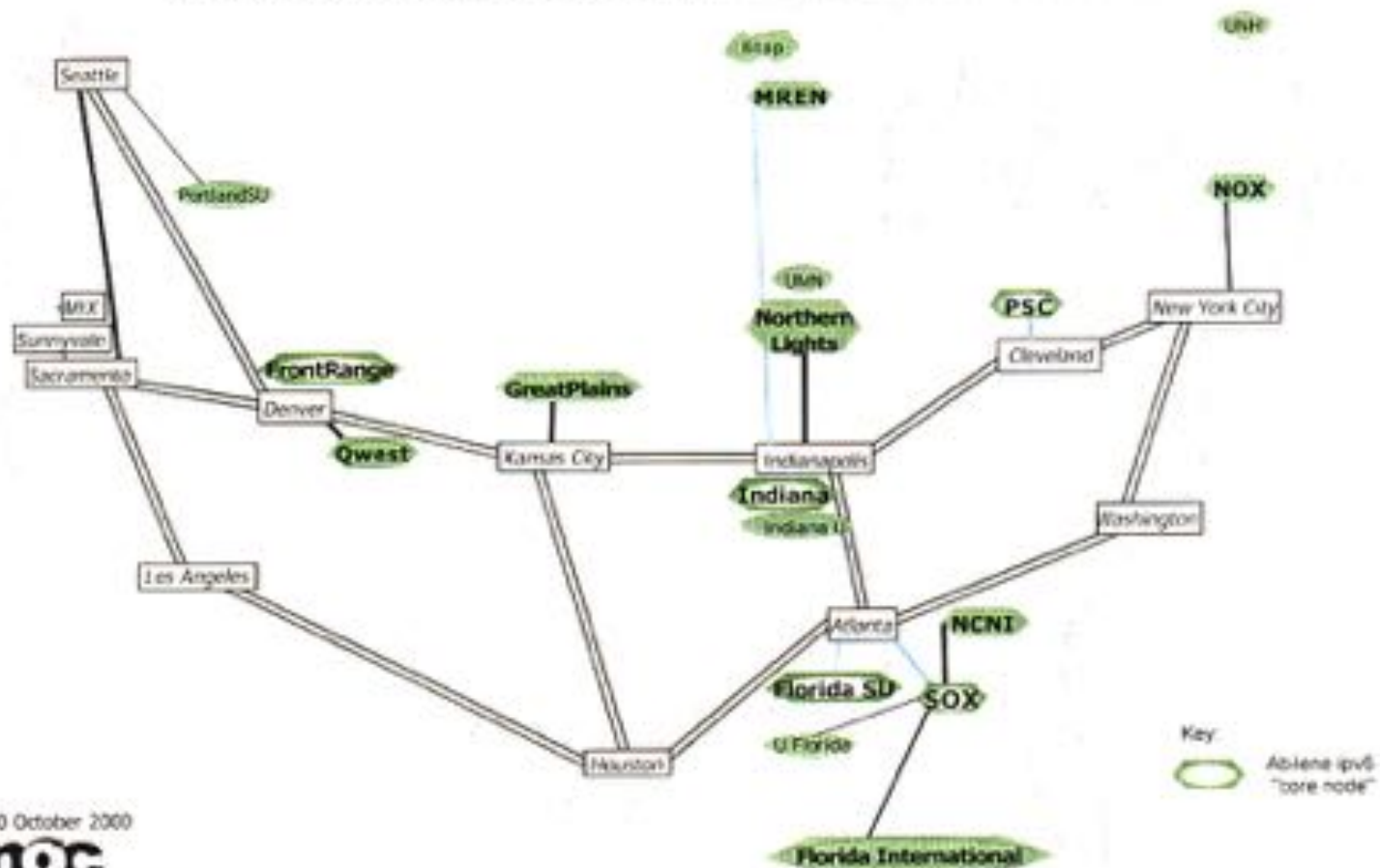
Adaptive Networks Operations Center
Indiana University
www.adaptive-networks.org

Key: 
 Road
 River
 Railway
 Boundary
 Forest
 Water

result showed a positive effect

The Abilene Network IPv6 deployment

Four Abilene ipv6 "core nodes" peer with each other, and other nodes with them



Key:
Abilene ipv6
"core node"

20 October 2000

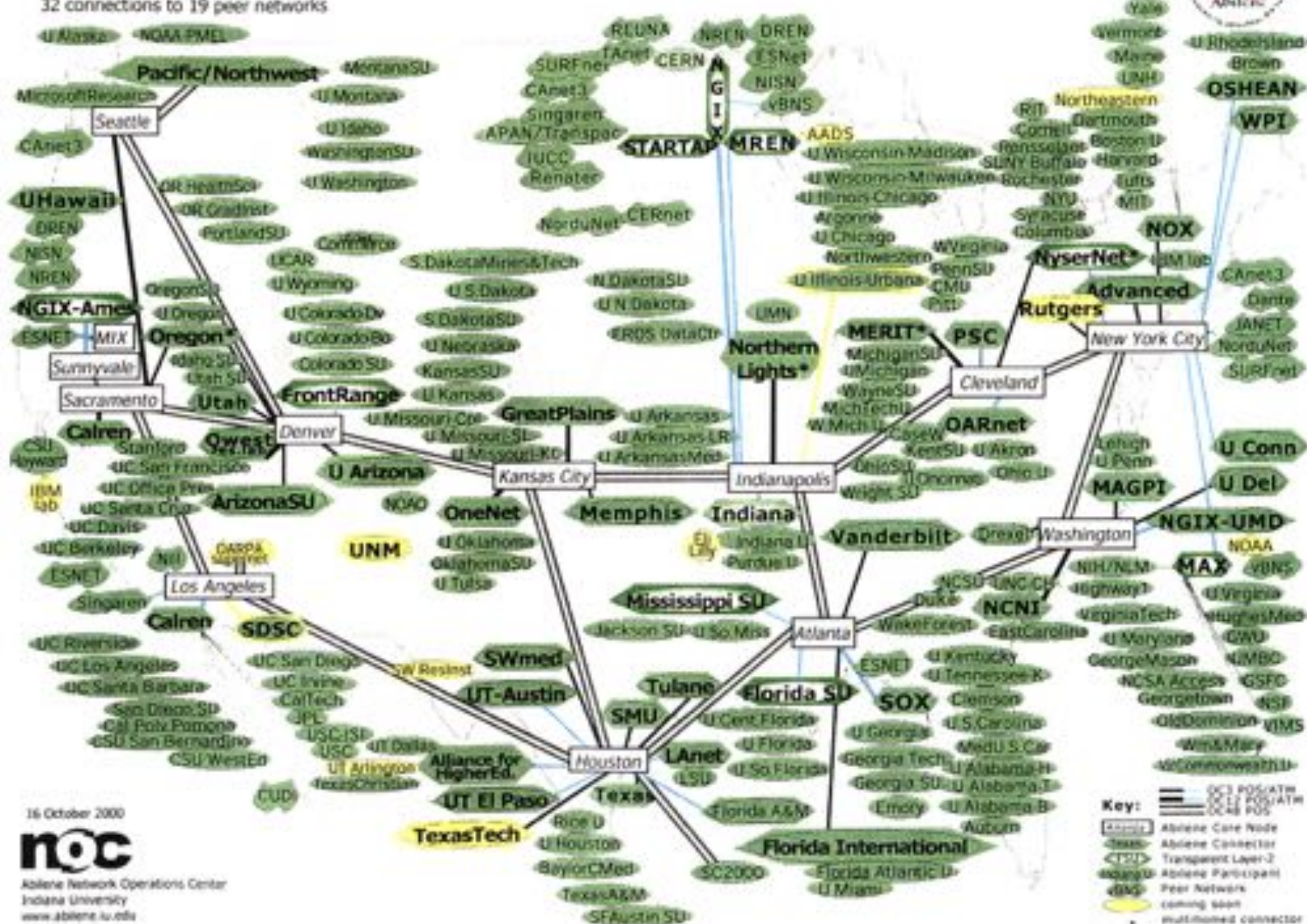
noc

Abilene Network Operations Center
Indiana University
www.abilene.cc.edu/images/ab.gif

The Abilene Network



completed connections:
178 participants
44 connectors + 3 NGDs + STAR TAP
32 connections to 19 peer networks



16 October 2000

noc

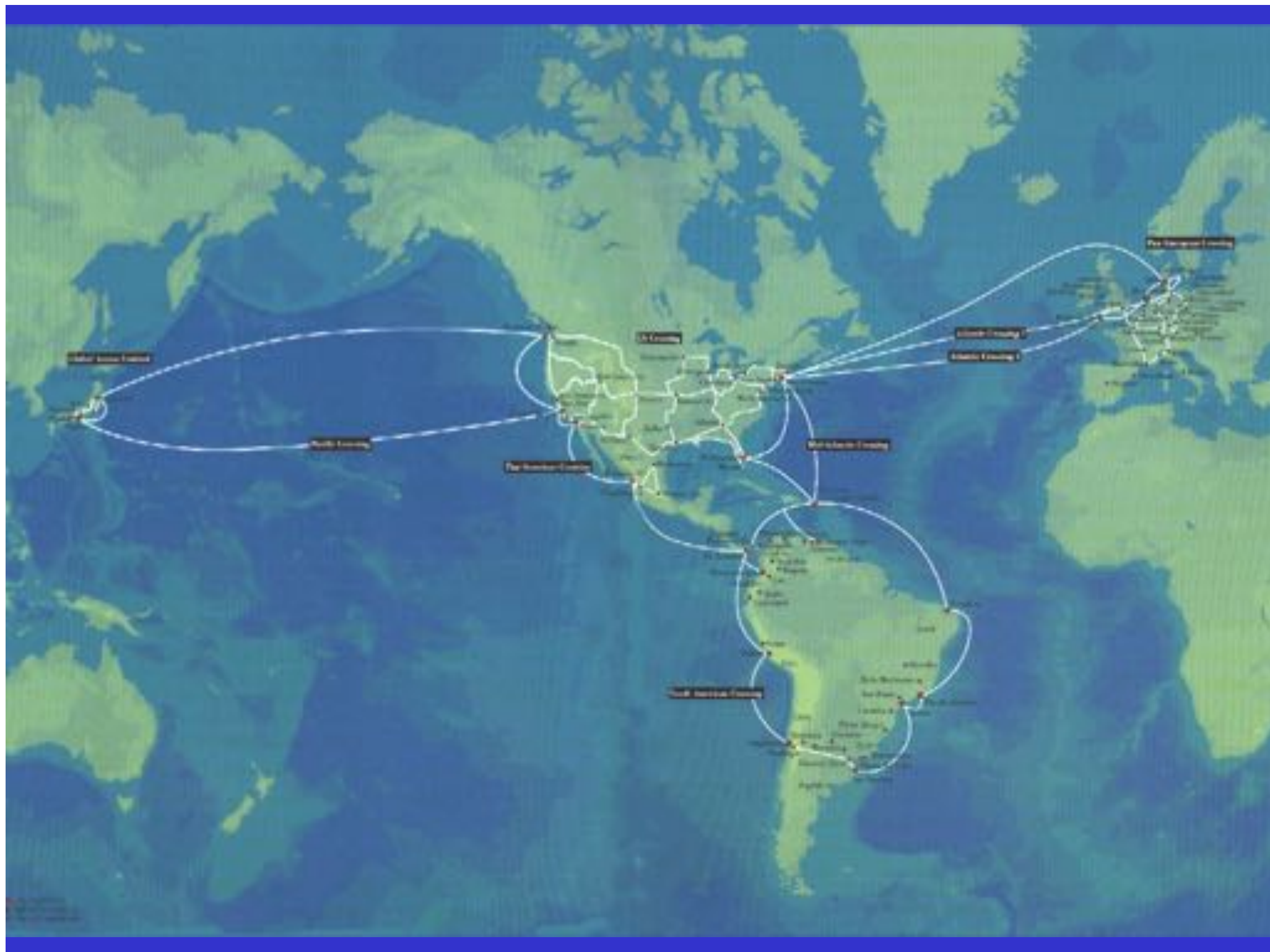
Abilene Network Operations Center
Indiana University
www.abilene.iu.edu



The Abilene Network

September 1998









- Landing Points
- Initial Connectivity
- Planned Expansion
- Connecting Systems

South American Crossing



FIU:

Gigapop for SE Florida
& Latin America





March 8, 2000

Meeting in Miami

- FIU and Global Crossing announced the AMPATH project to representatives from Argentina, Brazil, Chile, Columbia, Costa Rica, Puerto Rico, Venezuela, and US Virgin Islands.
- Participating in the meeting and supporting the AMPATH project were UCAID, STAR TAP and Canarie.



STAR TAPSM



CANARIE INC.



Global Crossing /AMPATH Partners

September 1, 2000

Argentina

Brazil

Chile

Columbia

Mexico

Panama

Peru

US Virgin Islands

Venezuela

Puerto Rico







Project Goal

- Establish a high-speed connection from the La Serena base station, Chile, to US National Research Networks (NRNs) and non-US NRNs.
 - Florida International University (FIU) proposes to connect the La Serena base station to Miami, Florida, where connectivity to US and non-US NRNs is available using Internet2's Abilene network.
 - Provide end-to-end high-speed connectivity between Gemini North and Gemini South.
 - FIU is in a unique position in being able to achieve this goal, because of its leadership role in the AMPATH project.



**Island of Hawaii
Gemini North
U of Hawaii, Oahu**

**Gemini South
La Serena**

DS3

**GC's POP
in Santiago**

**STAR TAP
Chicago**

**Internet2
(Abilene)**

DS3

**AMPATH POP
Miami**

**Gemini Connections
to AMPATH**

DS3

DS3

**GC's Terrestrial and
Submarine Network**





How We Make It So...

- Establish a DS-3 connection between Miami and Santiago using Global Crossing's submarine and terrestrial network
- Connect the Gemini, CTIO and SOAR networks to the AMPATH POP in Miami
- Using Internet2's Abilene network for transit, provide connectivity to US & Non-US NRNs



NAP of the Americas LLC

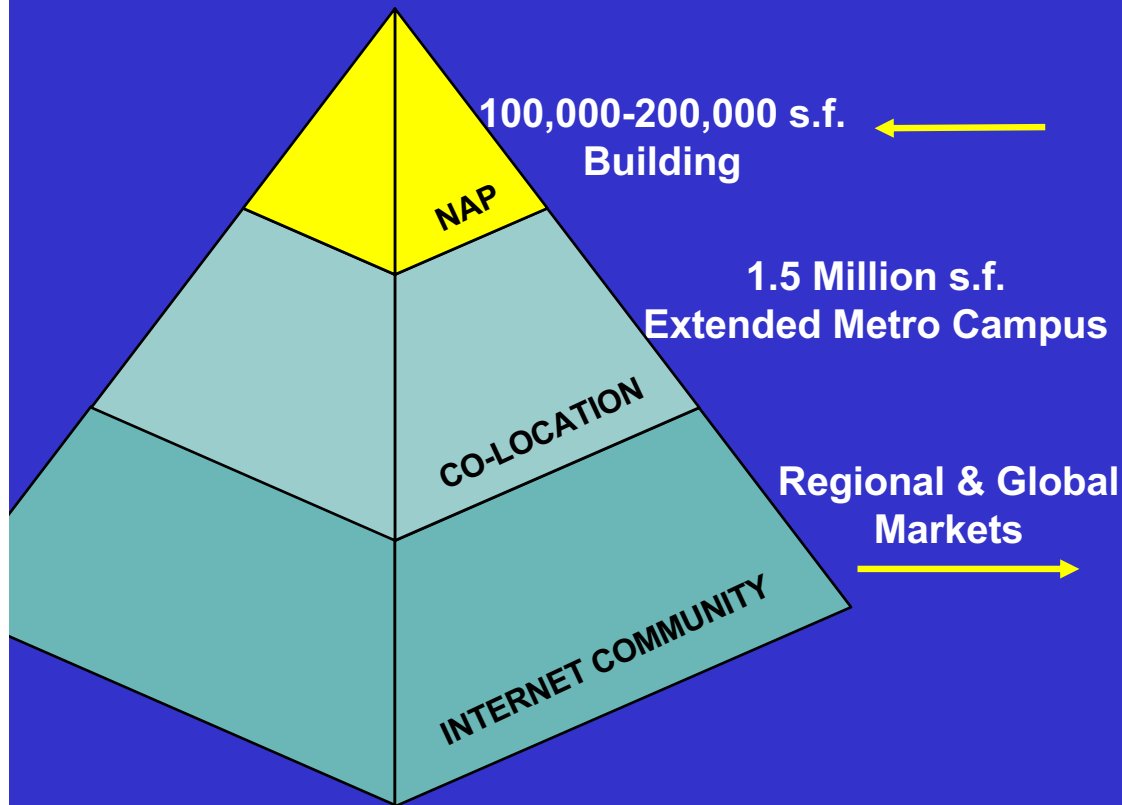


What is the NAP of the Americas?

- Consensus Point of Interconnect For Majority of Carriers, Non-Carriers, ISPs and End Users
- Offers Both Public and Private Peering
- Stimulates Internet Economy and Extended Digital Campus in South Florida and Beyond
- Evolves the Internet Beyond the current NAPs and MAEs
- Acts as a global gateway to Latin America, Africa and Southern Europe
- Provides Open Model for All Players to Gain Internet Access with
 - ✓ Good Price Points
 - ✓ Excellent Performance



Value Proposition for the NAP of the Americas

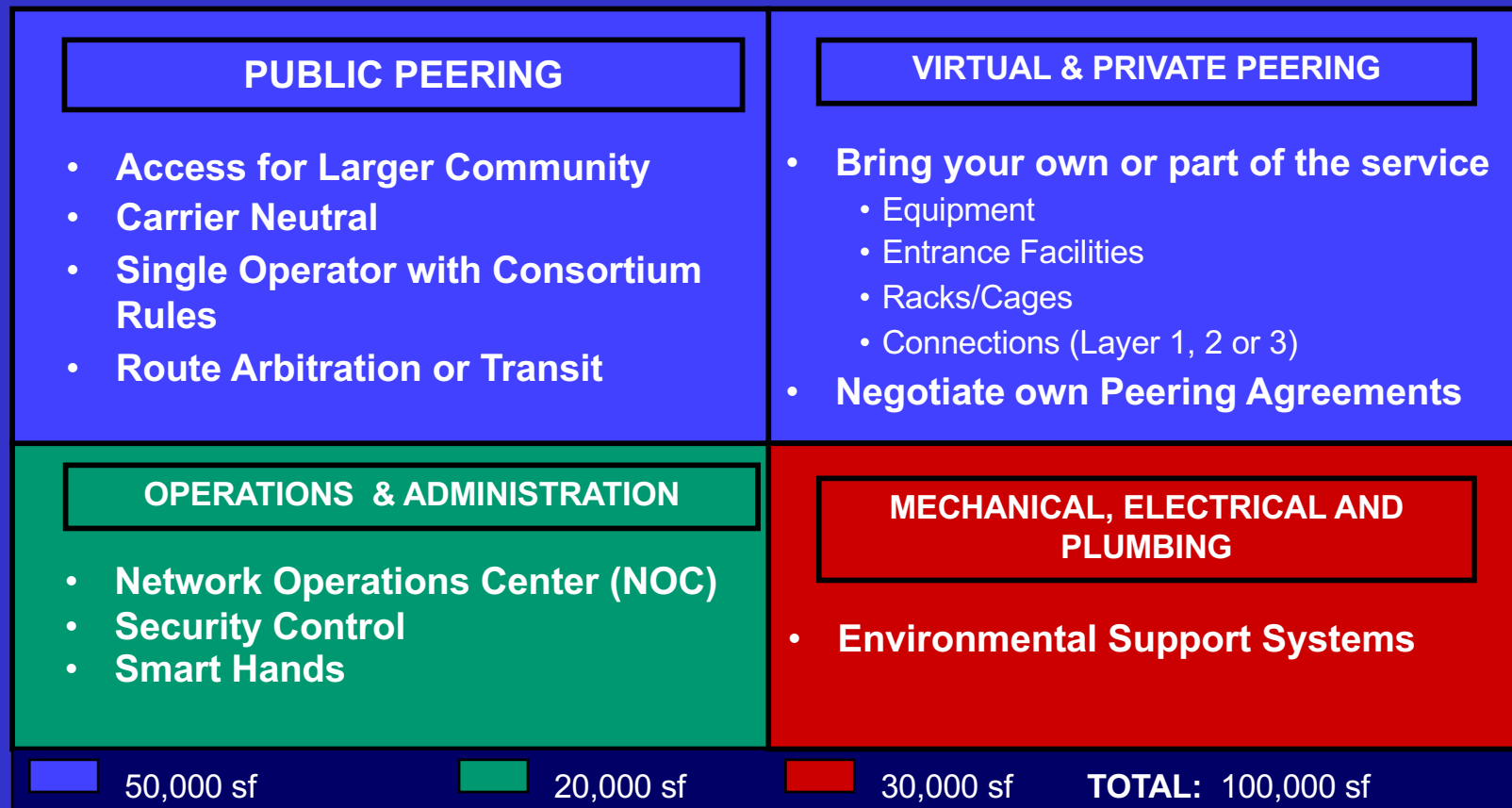


A NAP is the catalyst for building the extended Internet community

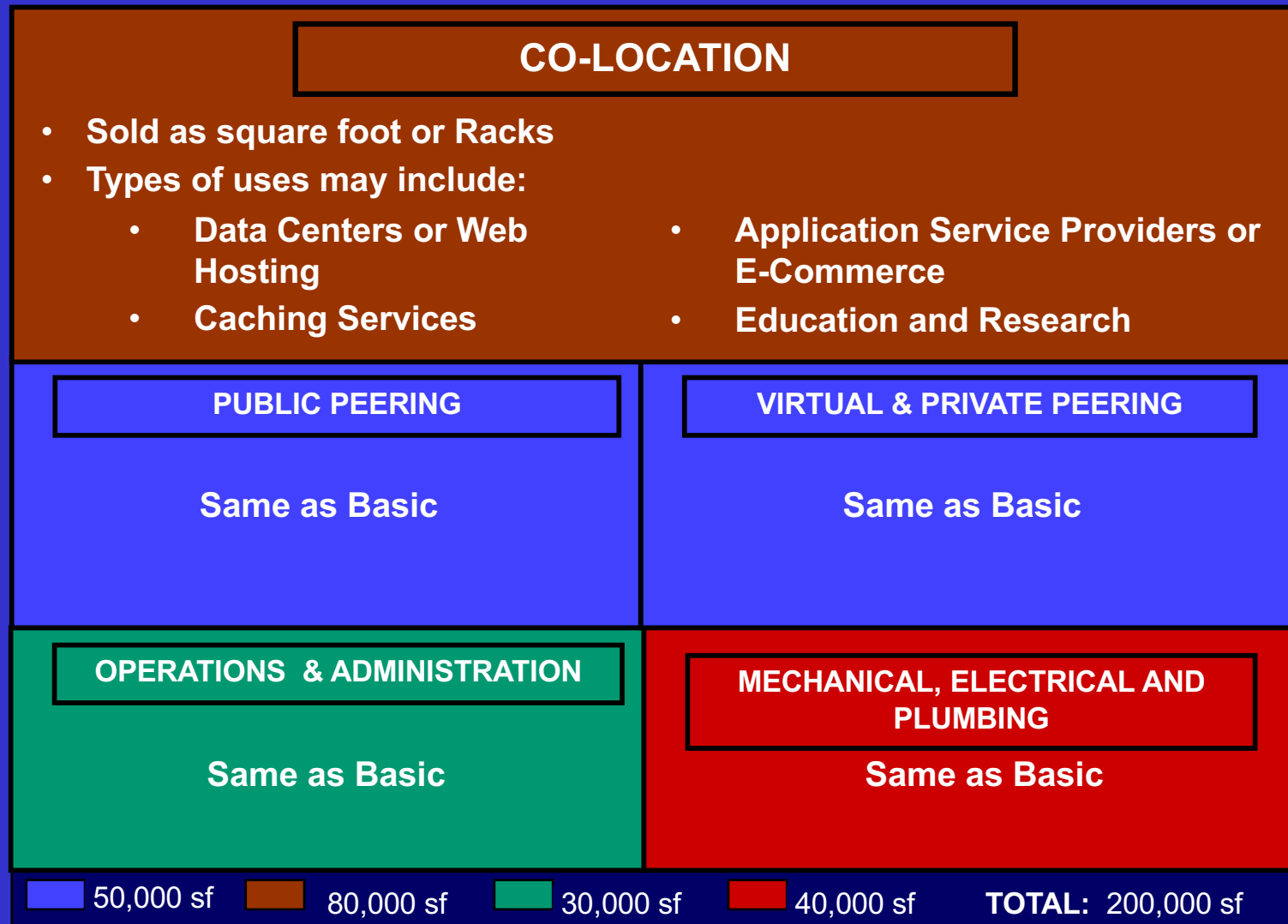


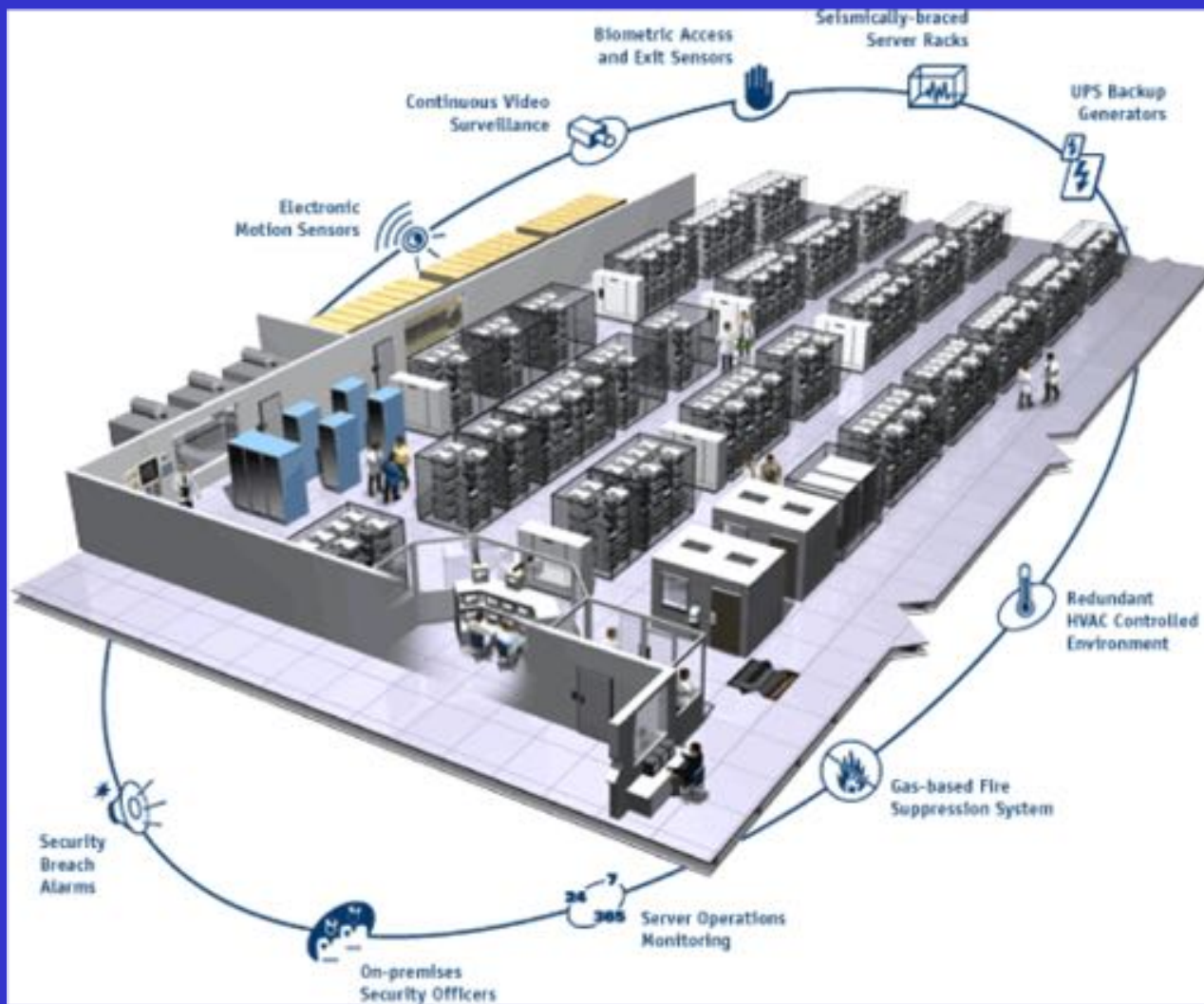
Major Fiber Routes & Cables

Basic Version of the NAP



Enhanced Version of the NAP





Infrastructure Criteria (Sites & Buildings)

What are the Important Criteria for Site Selection?

- Proximity to Fiber Routes
- Proximity to Carrier Location
- Minimum Two Power Grids
- On-site or Enclosed Parking
- Post war structure
- Industrial Zoning
- Accessibility to Site
- Void of Neighborhood Restrictions
- Federal, State, Local Development Zones
- Expandable
- Above Flood Plain
- Void of Hazardous Materials
- Fuel Storage Available
- Site Lines to Major Telecom Hubs
- Secure Area
- Unrestricted Air Rights

Possible Sites in Extended Miami Area

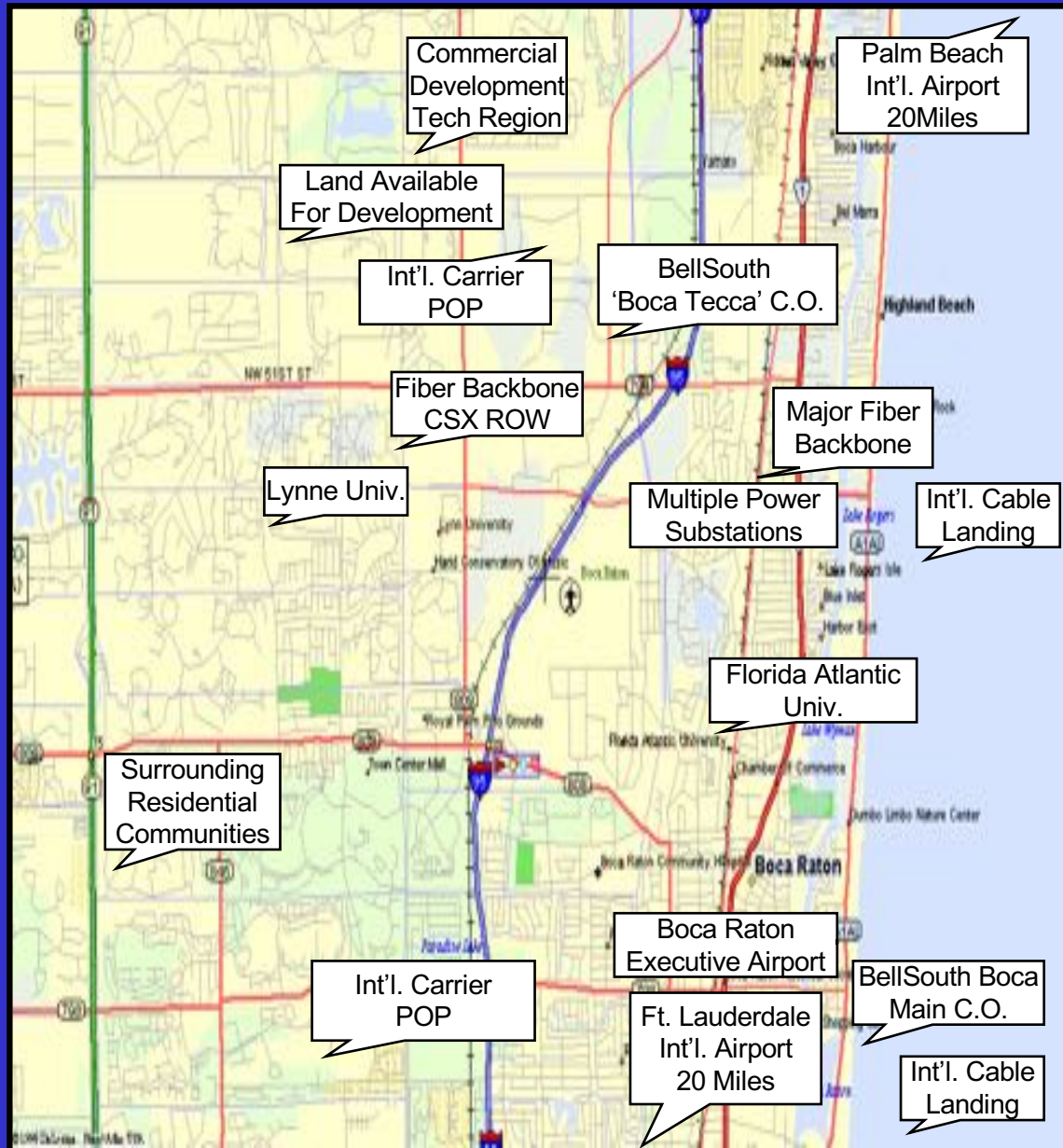


Boca Raton

West Dade

Downtown Miami

Boca Raton



Pros

- Major Fiber Routes available
- Proximity to Executive Airport
- International Cable landings nearby
- Desirable Environment
- Growing "Dot Com" Market
- Redundant Power Grids

Cons

- Distance from Int'l. Airport
- Lack of Federal, State or Local Development Zones

West Dade



Pros

- International Airport nearby
- Land available for development
- Desirable environment

Cons

- Limited Major Fiber Routes
- Limited "Dot Com" presence
- No Federal, State, or Local Development Zones
- Far from International Cabling Landing

Downtown Miami



Pros

- Major Fiber Routes nearby
- Carrier POPs nearby
- International Cable Landing nearby
- Federal, State and Local Development Zones Available
- Multiple Power Grids available

Cons

- Distance from International Airport
- Limited Dot Com presence

NAP Policy

Public Peering Area

- Transit from Carriers
- Route Arbitration Favors
- Least Cost Routes - controls prices
- User Fees based on Usage (\$/Terrabit)

Private Peering Area

- Open Mode
- Carrier Neutral
- Bring Your Own Equipment & Facilities
- Flexible but Secure
- Peering Negotiated by Individual Parties

Virtual Private Peering Area

- Same as Private Peering Minus Equipment Co-location
- Virtual Circuits to NAP for Peering

Co-location Area

- Secure
- Caged or Open Racks
- Sold By Square Foot or Rack Wholesale Space

NAP Access Charges

- Building Entry
- Cross Connect
- Port/Speed Type
- Space & Power
- Operations Charges

NAP Services

Public Peering Area

- **Core Management**
- **Element Management**
- **Service Accounting**
- **Service Level**
- **Management**
- **Smart Hands**

Private Peering Area

- **Core Management**
- **Smart Hands**

Virtual Private Peering Area

- **Core Management**
- **Element Management**
- **Service Level**
- **Management**
- **Smart Hands**

Co-location Area

- **A la carte Suite of Services**

Legend

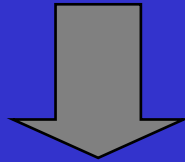
REQUIRED
OPTIONAL

Core Management Options for the NAP



Layer 2 Technology

- ATM
- Ethernet



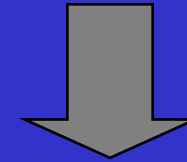
Advantages

- **Less Expensive**
- **Less Complex**
- **Virtual LAN Security**
- **Higher Port Density**
- **Greater Participant Control**
- **Scalability**



Layer 3 Technology

- IP

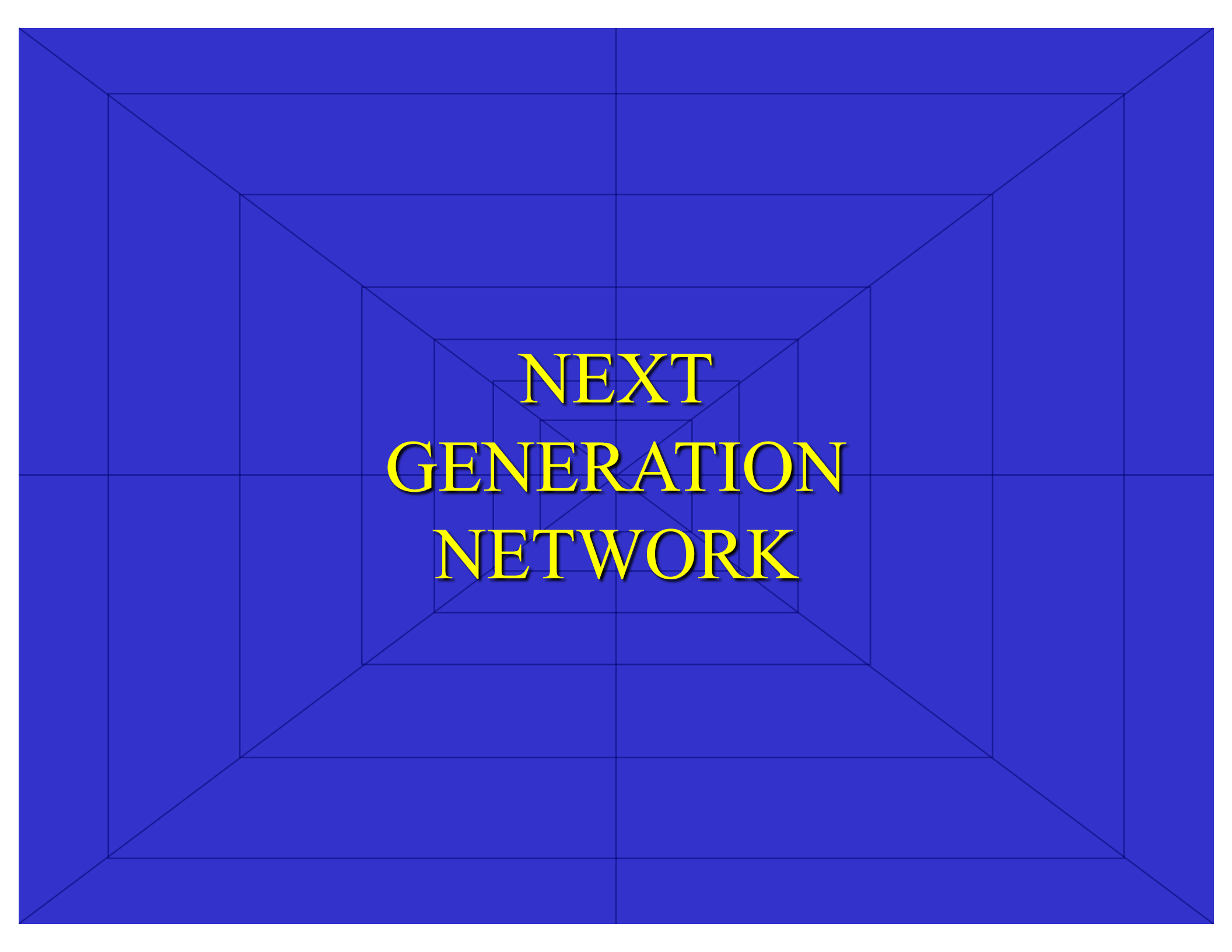


Advantages

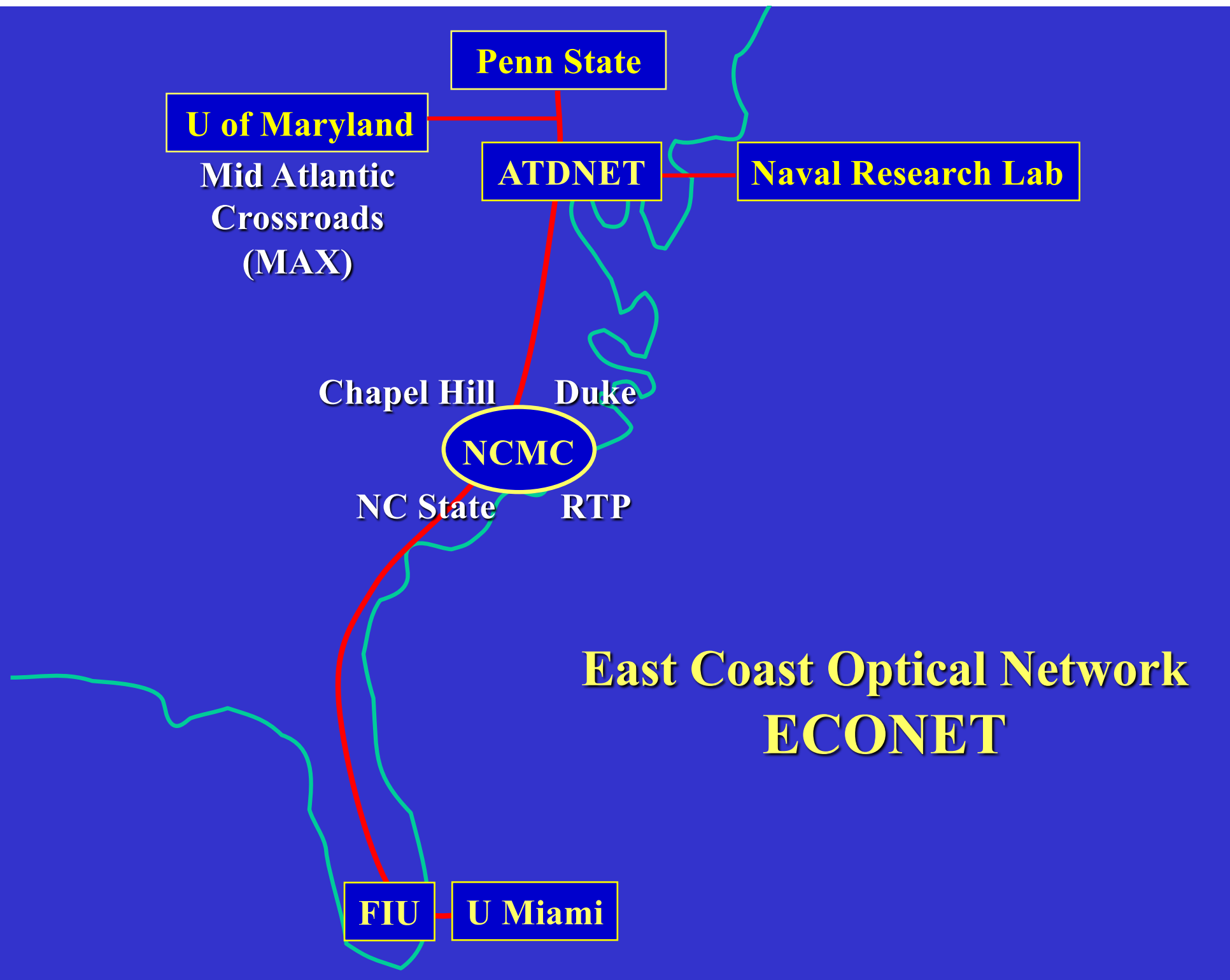
- **More Management Visibility**
- **OC-192 Today**
- **Better Statistics**
- **Ability to Implement Firewall**

Building It Together





NEXT GENERATION NETWORK



Partnership



FIU



THE CAPACITY TO PROVIDE RESEARCH AND EDUCATION TO THE WORLD

