NSF Award - #0441095

International Research Network Connections Program: Western Hemisphere Research and Education Networks (WHREN) - Links Interconnecting Latin America (LILA)

2005

Annual Report

Program Manager Kevin L. Thompson
OCI Office of CyberInfrastructure
O/D OFFICE OF THE DIRECTOR

Start Date: January 1, 2005
Expires: January 1, 2011 (Estimated)
Awarded Amount to Date $1,000,000
Investigator(s) Julio Ibarra, julio.ibarra@fiu.edu (Principal Investigator)
Heidi Alvarez, heidi.alvarez@fiu.edu (Co-Principal Investigator)
Chip Cox, chip.cox@fiu.edu (Co-Principal Investigator)
John Sylvester, jsilvest@usc.edu (Co-Principal Investigator)
Sponsor: Florida International University
11200 SW 8TH ST VH166
MIAMI, FL 33199, 305-348-4105

NSF Program(s): International Research Network Connections

This page intentionally left blank

Table of Contents

1. Introduction **4**
1.1 Background 4
1.2 Goals and strategies 4
1.3 Value to U.S. science 4
2. AMPATH Organization and Management **5**
2.1 Management 5
2.2 Operational Roles and Responsibilities 6
3. PROJECT OPERATIONS **6**
3.1 Open Model for Investment in System Design 6
3.2 Link Configuration 7
3.3 Customized Researcher Support 7
4. Milestones **8**
5. Progress Reports **17**
5.1 Year 1 17
5.2 Year 2 Proposed Actions 18
6. Outreach **20**
Appendix A: Measurement of WHREN-LILA Annual Traffic **31**
A.1 LILA-East Link 31
A.2 LILA-West Link 33
Appendix B Super Computing 2005 ..... **35**
Appendix C WHREN/LILA NOC Annual Report, 2005 ..... **37**

Table of Figures

Figure 1 LILA links in Year 1 6
Figure 2 COTIA Collocation Facility 10
Figure 3 Terremark NAP do Brasil option 10
Figure 4 Distributed Exchange Point Logical Diagram 11
Figure 5 Peering diagram of networks connected using LILA links 14
Figure 6 Shared L2 Network in Sao Paulo, Brazil 17
Figure 7 Daily Graph (5 Minute Average) - 12/13/2005 32
Figure 8 One Week Graph (30 minute average) 32
Figure 9 Weekly Graph (2 Hour Average) 32
Figure 10 Yearly Graph (1 Day Average) 33
Figure 11 CUDI/CLARA Peak Utilization 34
Figure 12 SC05 Bandwidth Challenge utilization over WHREN-LILA link to Sao Paulo 35
Figure 13 Sao Paulo and other sites participating in SC05 Bandwidth challenge 36

1. Introduction

1.1 Background

The WHREN/LILA project was funded January 1, 2005 as part of the International Research Network Connections program. This award, called WHREN (Western Hemisphere Research and Education Networks) addresses the existing and future needs for improved North American (especially the U.S.)–South American network connectivity. Activities focus on the need for improved connectivity through new network links: LILA (Links Interconnecting Latin America). WHREN formed a consortium of organizations from across the Western Hemisphere to participate in developing and operating a next-generation model for international networking that will foster collaborative research and advance education throughout the Western Hemisphere and other world regions. WHREN also serves to increase the rate of discovery both in the U.S. and across the Western Hemisphere. U.S. researchers are part of communities of scientists undertaking experiments that require increased and improved network resources throughout the Americas. WHREN-LILA aims to develop a cogent plan to support evolving researchers' needs and to foster new inter-disciplinary communities of researchers and learners.

1.2 Goals and strategies

The LILA project goals are to (A) complement the existing intra- and interregional networking activities with an infrastructure that interconnects North America (US, Mexico, and Canada) to emerging aggregation points in South America, (B) evolve the links as resources and economies permit to 2.5 Gbps and (C) implement a multi-service distributed exchange infrastructure that will provide a hybrid of scheduled temporary use and permanent use network resources to support discipline-specific and general-purpose high-performance computing and networking services over wide geographical distances. We have funding to provide two of the four proposed links, which will interconnect: Miami to São Paulo, and Tijuana to San Diego.

1.3 Value to U.S. science

A number of U.S. science initiatives depend critically upon facilities or environments located in Latin America. One example is observational astronomy. Astronomical observatories located, or to be located, in the Caribbean and South America include Arecibo Observatory, Pierre Auger, the Gemini South, CTIO and NOAO optical telescopes and the Atacama Large Millimeter Array (the latter two in Chile). Another example is the Inter-American Institute for Global Change Research (IAI). This intergovernmental organization coordinates research into environmental and socio-economic change in the Americas, and it counts 17 member countries in the Latin America area as well as the U.S. and Canada. Also, NASA's International Space Station (ISS) project seeks to provide access to the ISS for scientific investigators worldwide, including those in the Latin America. All of these U.S.-led initiatives now depend or will depend crucially upon high-speed connectivity between the U.S. and Latin America. Several federal agencies currently operate networks in Latin America using point-to-point low-bandwidth circuits. The WHREN/LILA project provides a coordinated and effective approach to these connectivity needs.

2. AMPATH Organization and Management

2.1 Management

The WHREN staff is detailed below:

Name	*Project Position/Title*	*Institution*
Julio Ibarra	PI	Florida International University
Donald A. Cox	Co-PI	Florida International University
Heidi Alvarez	Co-PI	Florida International University
John A. Silvester	Co-PI	CENIC
Susan Estrada	Senior Personnel	CENIC
Dave Reese	Senior Personnel	CENIC

The initial LILA project participants (herein also referred to as "Project Stakeholders") are FIU and CENIC (the Awardees), ANSP, CLARA, RNP, REUNA and CUDI. This group is responsible for the LILA project implementation and operation, and establishes LILA's readiness to support the mission and goals of WHREN (see WHREN Charter in the Appendix).

LILA Project Stakeholders are providing monetary support, infrastructure-technology resources and human capital toward the success of the project. In addition, Project Stakeholders support Communities of Interest (CoI) that are of strategic importance towards the success of the LILA and WHREN projects. To enable full participation of these CoIs, the Project Stakeholders connect at a LILA exchange/PoP, or to one of the other stakeholders and establishes appropriate interconnection and peering relationships.

The NSF LILA project is the de jure responsibility of the awardee, Julio Ibarra at FIU. To assist in communications and planning, the P.I. has established two advisory committees. Theses advisory committees are a Steering Committee and an Engineering Committee

The Steering Committee is comprised of one member from each of the Project Stakeholders.. The Steering Committee collectively makes strategic and operational decisions about the LILA project and shall provide this guidance to the Awardee. The Steering Committee is chaired by the P.I.. Members are the CO-PIs and:

Carlos Cassasus, CUDI, Mexico
Nelson Simoes, RNP, Brazil
Luis Lopez, ANSP, Brazil
Paola Arellano, REUNA, Chile
Florencio Utreras, CLARA, Uruguay

The Engineering Committee is comprised of network engineers from each of the Project Stakeholder organizations, as well as invited subject matter experts. The primary responsibility of the Engineering Committee is to make technology, engineering and operational recommendations to the Steering Committee.

2.2 Operational Roles and Responsibilities

Figure 1 LILA links in Year 1

As Figure 1 shows, LILA links terminate at exchange points in Miami and Sao Paulo, and PoPs in Tijuana and San Diego. At each location, project partners provide operations and engineering support. NOC Support is provided by the Global NOC and by CENIC, in coordination with the engineering teams at each location.

3. PROJECT OPERATIONS

LILA is an open system design model, a strategic partnership with links and distributed peering exchange providers, variable link configurations, and customized researcher support. Consortium members, including participating vendors, will provide link-terminating equipment.

3.1 Open Model for Investment in System Design

If particular research groups are interested in dedicated bandwidth on the LILA topology, they are invited to participate in WHREN to provision it.

An example might be the Gemini Observatory in Chile. While our proposed links provide the Gemini with general-purpose network connectivity, Gemini has two options for pursuing 'committed' bandwidth for use during observations. Through the consortium, they can propose, as a research group, for a specific network configuration (such as a guarantee of 150 Mbps from

Chile to Chicago). The consortium will analyze the available resources and try to support the Gemini project's committed network resource need. If existing resources are not available Gemini can invest to augment the links with an additional 155Mbps from Chile to Tijuana. Gemini now has a guarantee of that amount available for a price significantly lower than through a separate procurement, and the opportunity to work with the consortium to burst beyond that. Whenever Gemini is not using the committed bandwidth, the general-purpose research and education users of the links benefit from the increase in bandwidth paid for by Gemini.

3.2 Link Configuration

The links provide a hybrid of scheduled temporary use and permanent use network services to support discipline-specific and general-purpose high performance computing and networking services over wide geographical distances. As such, the links are configured for (1) permanent-shared to support international production traffic; (2) permanent-dedicated use to support high-performance discipline- or application-specific Community of Interest traffic; or (3) scheduled use to support temporary deterministic application traffic.

The links are able to support a number of services to end users, examples including:

1. High-speed data transfer. Supported by UCLP, and FAST TCP;
2. Real-time collaboration. Supported by UCLP, and the Virtual Rooms Video Conferencing System (VRVS)[1];
3. Real-time high throughput visualization for VLBI. Supported by UCLP and/or UDP.

The services to the end users will evolve to being enabled by: (1) dynamically provisioned end-to-end lightpaths for individual sessions that support efficient resource utilization and QoS guarantees; and (2) shared resource access with high performance transport protocols designed to adapt to the high bandwidth delays produced by the long-latency network environment (e.g., FAST TCP).

IPv6, IPv4 and Multicast will be supported using layer-3 routing protocols, such as RIP, OSPF, IS-IS, BGP, IP multicast, natively.

3.3 Customized Researcher Support

LILA offers multiple levels of QoS services to the research applications. LILA can provide best effort through layer2/3 VLAN/routed-packet services. For applications with specific QoS requirements, we can incorporate dynamic resource provisioning and associated resource usage monitoring, traffic accounting, etc. These QoS mechanisms include packet classification, traffic policing, differentiated service supports, active queue management, as well as layer-1 lightpath dynamic provisioning.

To determine how to satisfy a user's QoS request, we need to assess the resource usage in the network, and make necessary resource reservation at various points of the network. This requires a comprehensive end-to-end monitoring mechanism able to provide precision real-time and historic information about the health of the software (applications, middleware and operating systems) and hardware (hosts and network) operations, including, but not limited to, data analysis

[1] http://www.vrvs.org/

tools for event analysis and visualization of traffic exchanged with the peering networks, point-to-point bandwidth availability, packet loss rates, end-to-end delay statistics, etc.

4. Milestones

January 2005: Revise five-year plan due to award/proposed difference
The difference between the annual award amount and the originally proposed budget was nearly $1 Million dollars. After a series of conversations with the partners, it was decided that the proposed leased circuit from Santiago to Tijuana would be omitted. This was decided because the planned exchange in Chile did not materialize, with only the Chilean network present. At both the Sao Paulo and Tijuana exchanges there were multiple networks that could utilize LILA. Additionally Sao Paulo-Santiago lease rates were reasonable so that it would not be an insurmountable obstacle for peering. CLARA would be used to connect the general research and education traffic from Chile to the U.S. through either a South Eastern (Sao Paulo) or South Western (Tijuana) open exchange. In the first year FAPESP agreed to fund the Miami-SP link at higher than previously agreed upon level due to the budget short fall. This meant that FAPESP would be paying 85% of the first year lease cost, and then in subsequent years the amount would return to 50/50. Mechanically, FAPESP would cover the full cost of the first three quarters of the year, and then return to the planned equity for the fourth quarter allowing us to move the remainder of an existing lease contract with Global Crossing to Latin American Nautilus.

January 2005: Negotiated Contract with Latin American Nautilus for capacity lease
In the planning for the proposal, various vendors were asked to provide a quote for 20-25 year right to use on fiber across the border between San Diego and Tijuana. The only company that was willing to sell such a product was Global Crossing. During the planning of the proposal, Global Crossing offered the fiber at $500,000. Subsequent to the proposal being awarded, the price changed. After lengthy negotiations, the price remained at more than $500K. The WHREN/LILA award paid $480,000 for this, and the WHREN/LILA awardees paid the difference and all the equipment required in Tijuana.

The contract allowed for broad renegotiation. Of particular interest was moving from protected (the only technically available circuit on the cable now) to unprotected circuits as soon as it would be possible. The WHREN/LILA team engaged LAN in both technical and business plan discussions. It is anticipated that by the end of the year this contract would be renegotiated to match the IRNC funding period.

January 2005: Established communication channels
To support effective communication of the project, several mailing lists were created. The lists were pre-populated with the following names:

WHREN-TODAY (Newsletter)	WHREN-LILA-ENG:	WHREN-LILA-STEERING:	WHREN-LIST
anne@aldea.com	alex@rnp.br	ccasasus@cudi.edu.mx	avery@phys.ufl.edu
ccasasus@cudi.edu.mx	algold@rnp.br	chip@fiu.edu	awhitney@haystack.mit.edu
celestea@usc.edu	bac@cenic.org	dave@cenic.org	bill.st.arnaud@canarie.ca
chip@fiu.edu	ccosta@cenic.org	eporto@rnp.br	ccasasus@cudi.edu.mx
cnewton@ufg.edu.sv	chip@fiu.edu	florencio.utreras@redclara.net	chip@fiu.edu
concordia@aldea.com	dave@cenic.org	hans@noc.redclara.net	delaat@uva.nl
corbato@internet2.edu	eporto@rnp.br	heidi@fiu.edu	dlapsley@haystack.mit.edu
ernesto@cs.fiu.edu	ernesto@cs.fiu.edu	ileana@fiu.edu	futreras@reuna.cl
futreras@reuna.cl	esj@cs.fiu.edu	jdolgonas@cenic.org	heidi@fiu.edu
gscott@cenic.org	florencio.utreras@redclara.net	jsilvest@usc.edu	jsilvest@fiu.edu
heather@internet2.edu	gcicileo@retina.ar	julio@fiu.edu	julio@fiu.edu
heidi@fiu.edu	guilherme@rnp.br	kthompso@nsf.gov	kennedy@gemini.edu
julio@fiu.edu	hans@noc.redclara.net	lopez@dim.fm.usp.br	lconrad@mailer.fsu.edu
jdolgonas@cenic.org	heidi@fiu.edu	michael@rnp.br	lopez@dim.fm.usp.br
lopez@dim.fm.usp.br	jdolgonas@cenic.org	mmurom@cudi.edu.mx	lsmarr@ucsd.edu
nelson@na-df.rnp.br	jrgmrcs@ansp.br	nelson@na-df.rnp.br	maidique@fiu.edu
sestrada@aldea.com	jsilvest@usc.edu		nelson@na-df.rnp.br
silvester@usc.edu	julio@fiu.edu		newman@cac.caltech.edu
stgeorge@unm.edu	lopez@dim.fm.usp.br		nlock@gemini.edu
	michael@rnp.br		novaes@fnal.gov
	mmurom@cudi.edu.mx		Robert.N.Bradford@msfc.nasa.go
	rliope@usp.br		ronj@cac.washington.edu
	xsu@hep.caltech.edu		santoro@uerj.br
	yamamoto@ansp.br		tom@uic.edu
			twest@cenic.org
			uose.hisao@lab.ntt.co.jp

The WHREN-LILA Steering group would meet by phone and video-conference every other Wednesday. A newsletter would be sent out to the list and to news sources every quarter. The newsletters and general information is made available at www.whren-lila.net .

February 2005: Discussion of the network interconnections in Sao Paulo

Two topologies were discussed, shown below as Figure 1 and Figure 2. These diagrams are from the PowerPoint presentation with filename RedCLARA_IRNC-en3.ppt

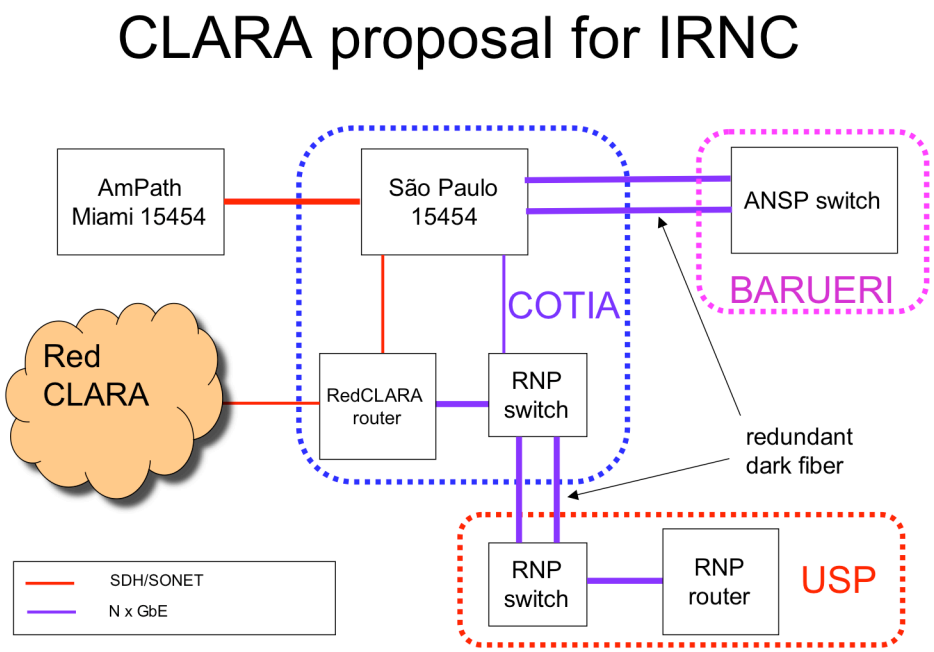

Figure 2 COTIA Collocation Facility

Figure 2 shows the NSF-funded CHEPREO project Cisco optical mux located in the COTIA collocation facility.

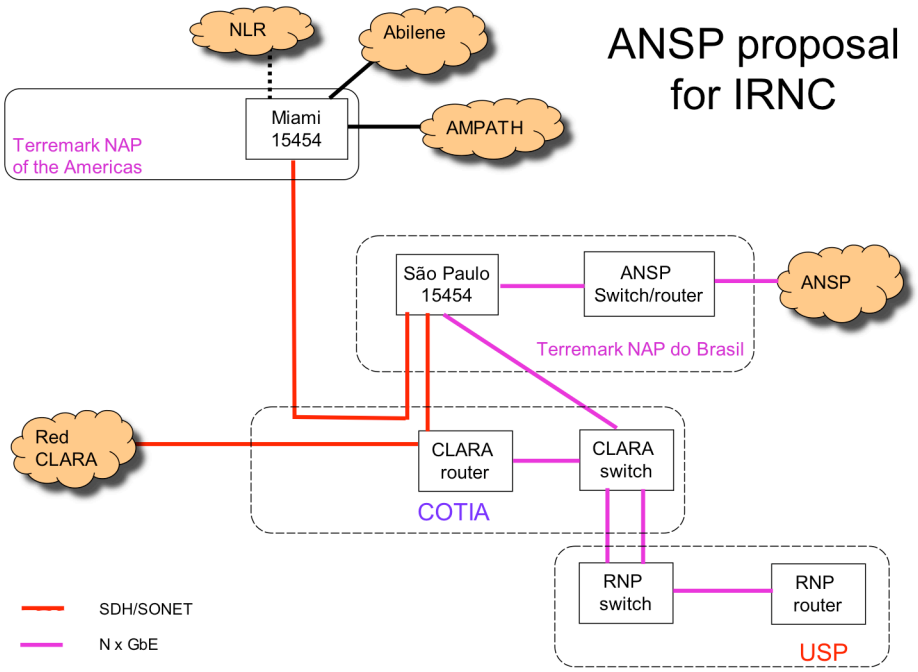

Figure 3 Terremark NAP do Brasil option

Figure 3 shows the NSF-funded CHEPREO project Cisco optical mux located in the Terremark NAP do Brasil. The WHREN-LILA steering group agreed that both options were topologically equivalent. FAPESP funding requires an open and neutral facility. It was decided that a distributed exchange point architecture would be used that interconnects the Cotia, Barueri and USP PoPs, using the existing fiber pairs between each POP. An arbitrary number of WDM lambdas can then be provisioned for different applications. This would also for multiple link technologies to be used. Figure 4 shows the agreed upon distributed exchange point topology in Sao Paulo.

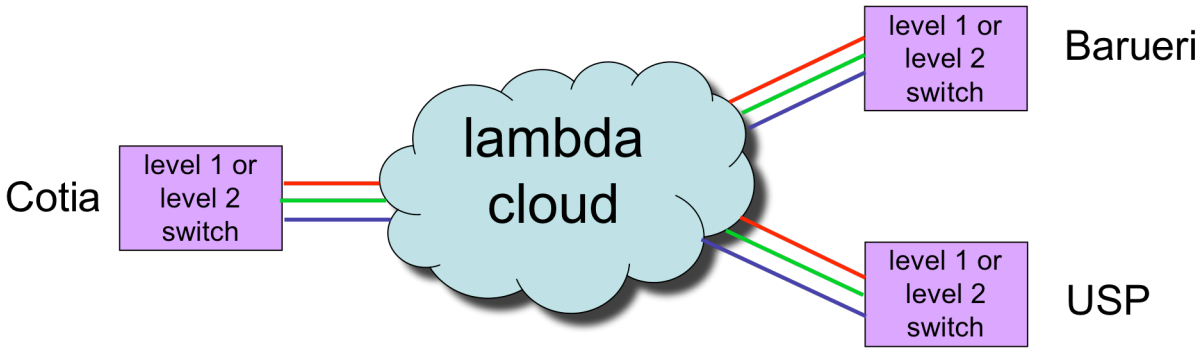

Figure 4 Distributed Exchange Point Logical Diagram

The lambda cloud, shown above, created by the WDM infrastructure permits the arbitrary interconnection of pairs of layer 1 or 2 devices in the different POPs connected to the cloud. The Cisco ONS 15454, provided by the NSF-funded CHEPREO project, will be used to facilitate the interconnection of these layer1 and 2 devices.

March 2005: The funding model for WHREN/LILA was shared with the WHREN/LILA steering group. In the first year $1,000,000 of NSF funds would be spent with $480,000 for the TJ-San Diego Fiber Purchase, $140,000 for Engineering and Operations at both FIU and CENIC, and the remaining $240,000 would go to the Miami-SP lease. In subsequent years $760,000 would go towards the lease. FAPESP's budget of $1,000,000 would contribute $840,000 to the lease, and $160,000 to engineering and in Sao Paulo. FIU and CENIC would each contribute all the necessary equipment from other funding sources. Regional networking would be provided by CLARA, which would spend approximately $2,500,000 a year on networking, with DANTE/ALICE providing $2,100,000 and the 13 members of CLARA each paying a pro-rated amount weighted by the capacity they received on the STM-1 backbone, totaling $400,000 a year.

April 2005: LILA Kick off meeting, held April 30th

The LILA project held a kickoff meeting in conjunction with a CLARA and CUDI meeting in Veracruz, Mexico. Attending were representatives from ANSP, CENIC, CLARA, CUDI, FAPESP, and FIU. A methodology for operations was discussed including:

a. Coordinated Engineering
b. NOC services
c. Outreach and Publication

This face-to-face meeting was an important opportunity to develop international co-operation. The outcome beyond the technical concepts addressed, was a sense of momentum to the project.

April 2005: Initiated Equipment transfers to Sao Paulo and Tijuana
FIU and CENIC received funding through separate awards / sources for optical and Ethernet switches to locate in Tijuana and Sao Paulo.

d. There was a problem receiving the equipment for the Tijuana side and it was returned. The importer then refilled papers and the majority of the shipment was accepted. The shipment was split to remove the "made-in-china" parts, which caused issues with the import-clearing house. We had two reports of potential 1000% duty on those two items because of their country of origin. After a delay, the parts were returned to California. CUDI representatives who addressed the importation issue then picked up the parts. This was an unforeseen delay.
e. The customs shipper was unable to secure clearance papers for a duty free status for the shipment to Brazil. After a month of delay, not being able to secure the transit paperwork, it was recommended to ship the box and then allow FAPESP to address the customs waiver issue. The shipment was delivered and paper work filed by FAPESP to liberate the shipment. This did not happen during this quarter.

May 2005: Negotiated Contract with Bestel for Tijuana Cross connect
A cross connect is needed between CUDI/CLARA and the equipment that CENIC provided on the Tijuana side of the cross connect. The location of the open exchange is at a pop owned by Bestel. The CLARA space is rented by DANTE. In order to request a price, DANTE worked off of a master contract. The price was quoted at $6,400 a month. CLARA and CUDI stated that they had no funding for this, and expected that WHREN/LILA would pay for this. Traditionally, networks each pay for their respective side's cross connects. CENIC paid for the cross connect in San Diego out of non-WHREN/LILA funds. There was a great deal of effort to negotiate the cross connect fee down. In order to keep momentum, the WHREN/LILA awardees agreed to pay for the cross connect on a month-to-month basis until a better price could be established.

May 2005: Funded GX contract
Fund transfers were effectively made to execute the Global Contract purchase order and secure the fiber.

June 2005: **Entered into contract with LAN**
The contract negotiations with LAN resulted in a successfully executed Master Service Agreement, and the capacity schedule.

June 2006: Started Engineering Group
The engineering group began to meet bi-weekly to address configuration and peering issues. Of particular concern was the tunneling of CUDI/CLARA traffic across CALREN to the PacificWave node in Los Angeles. The preferred solution was to extend PacificWave, but funding was not readily identifiable to do that at this time.

June 2006: No progress on extricating SP equipment
Customs in Sao Paulo has held the Cisco ONS box. The paper work that transferred the box to FAPESP was completed prior to shipment, and the expectation was that due to its use for research, no duties would be necessarily paid. However, there was an objection to this classification by a third party. The third party is a Brazilian manufacturer of routers, who believes that only its products should be used by the State of Sao Paulo. To document that the box was associated with a specific research project, a new proposal was written and approved by FAPESP to link the box to research.

The private company has challenged this classification. The customs/importation process that the Cisco ONS box is in has the possibility for three challenges. This constituted the first of those three. The customs council met and sided with FAPESP's interpretation. However, the ONS box will not be released, as the private company has objected again, and is eligible to object a third time.

It is anticipated that after all three reviews the box will be released without taxes due. However the committee meets infrequently. It is possible that the ONS will be released in less than thirty days or more than four months. At this point, pursuing other options, such as paying the 50% duties, would in the opinion of the experts at FAPESP delay the process even further.

July: Tijuana-San Diego Link Interconnecting Latin America Inauguration at the Border Governor's Meeting
The San Diego –Tijuana LILA was lit with 1 Gb/s connectivity to support the aggregate 310Mb/s of CLARA capacity and 155mb/s of CUDI traffic. The link's completion was announced at the Border's Governor's meeting in Torreon in the Mexican State of Coahuilla. The CLARA/CUDI Cross connect price was negotiated down to $2,000 a month, and the WHREN-LILA awardees agreed to cover this charge for one year, until permanent funding could be arranged. In anticipation of the need for additional capacity, plans are underway to upgrade the link to 2 one gig connections. For example, it is possible that the research facility at Ensenada will also peer in Tijuana, bringing in a Gig of connectivity before the year end.

August: Established Sao Paulo, COTIA peering plan
A meeting was held on August 30th in Sao Paulo to establish a plan for ANSP/RNP/CLARA/LILA peering in Sao Paulo. Previously RNP/CLARA had requested that we wait to begin peering until the ONS box was available. With no credible date for ONS availability, the LILA steering group agreed to proceed with peering using existing equipment.

Sao Paulo Open Peering Execution Plan:

1. Request Quotation- Eriko
To be completed by September 2nd
(Eriko will deal with Dante to address this)

2. Order Transceivers / Cross Connect Cables for RNP/Clara- Eriko
To be completed by September 2nd (delivery time is estimated to not exceed 45 days)
Chip will see if the one ordered for Tijuana is available; it did not get delivered.

3. Order x-connect- Eriko
(Eriko will need to work with Dante to address the contracting issues)
to be completed by September 12th.

4. Install Patch cords/transceiver (Eriko and Jorge Yamamoto and Marcos)
Multi-mode optical SX gig-a-bit Ethernet
To be done by September 19th (using loaner transceivers if they are not in yet)

5. Establish the Peerings (Eriko, Ernie, Jorge Yamamoto and Marcos)
Multi hop BGP
To be done by September 23rd.

Figure 5 below shows the peering diagram, as an outcome of this meeting.

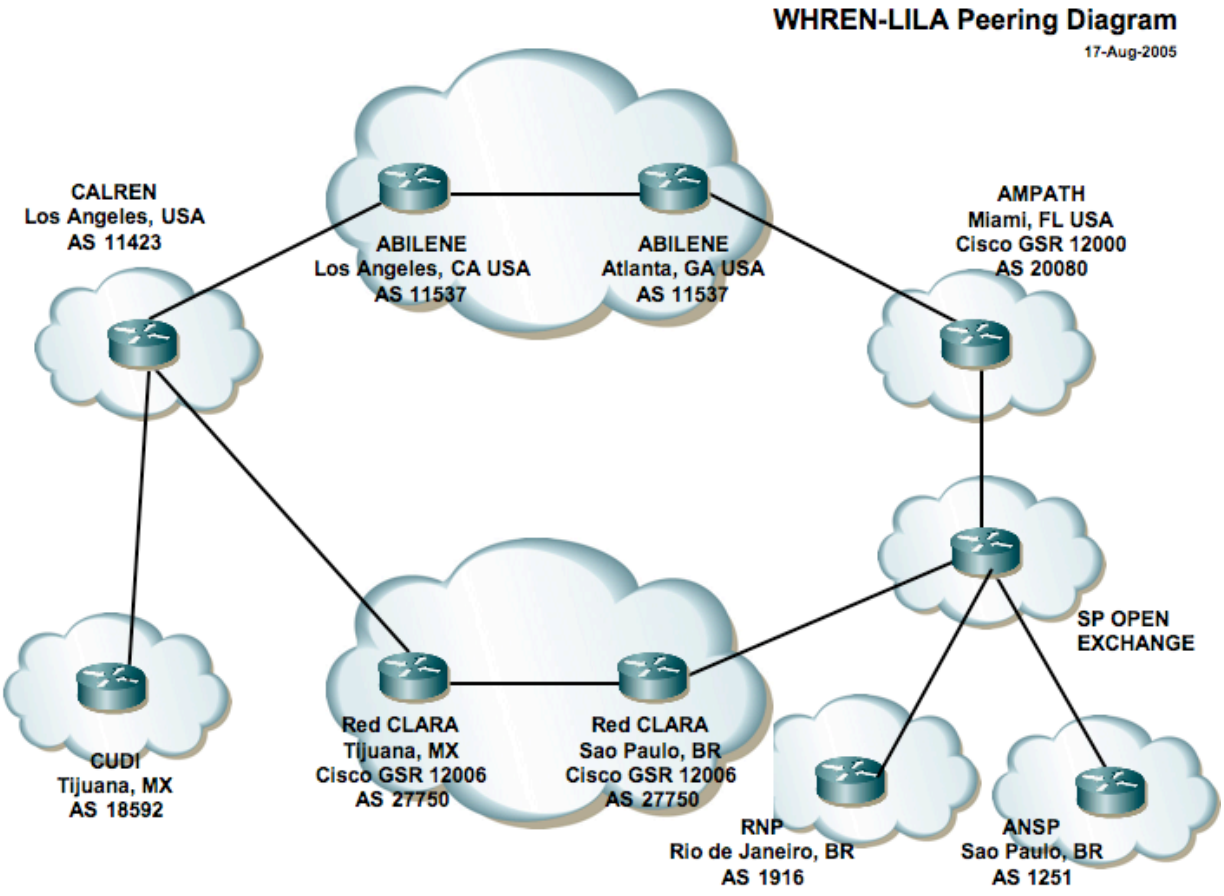

Figure 5 Peering diagram of networks connected using LILA links

September: Held 1st WHREN meeting

The first WHREN meeting was held in conjunction with the iGRID/GLIF meeting in San Diego, California on September 29th. The following people attended:

First	*Last*	*Address*	*Entity*
Heidi	Alvarez	heidi@fiu.edu	IRNC-WHREN/LILA, Ampath
Heather	Boyles	heather@internet2.edu	Internet2
Joseph	Burrescia	joeb@es.net	ESNET
Carlos	Casasus	ccasasus@cudi.edu.mx	CUDI
Greg	Cole	gcole@gloriad.org	IRNC-Gloriad
Steve	Corbato	corbato@internet2.edu	Internet2, MANLAN
Chip	Cox	chip@fiu.edu	IRNC-WHREN/LILA, Ampath
Susan	Estrada	sestrada@aldea.com	Adea communication
Jim	Dolgonas	jdolgonas@cenic.org	CENIC
Jan	Eveleth	eveleth@cac.washington.edu	PacificWave
Julio	Ibarra	julio@fiu.edu	IRNC-WHREN/LILA, Ampath
Tim	Lance	tl@nysernet.org	NYSERNET
David	Lassner	david@hawaii.edu	U. Hawaii
Fernando	Muro	mmurom@cudi.edu.mx	CUDI
Dave	Reese	dave@cenic.org	CENIC
Don	Riley	drriley@umd.edu	IEEAF
John	Silvester	jsilvest@usc.edu	IRNC-Translight/PacificWave
Jerry	Sobieski	jerrys@maxgigapop.net	MAX
Bill	St. Arnaud	bill.st.arnaud@canarie.ca	Canarie
Michael	Stanton	michael@rnp.br	CLARA, RNP
Garret	Yoshimi	hawaii - for Lassner	University of Hawaii
Tom	West	twest@cenic.org	NLR
Matt	Zekauskas	matt@internet2.edu	IRNC-Measurement
Zita	Wenzel	zita@isi.edu	ISI

The meeting focused on four key steps:

A. Western Hemisphere Conference: A PRAGMA like applications focused meeting uniting researchers across the Western Hemisphere

B. Web Forum for communication: Establishing an XML based central site that draws from all the RENs in the Western Hemisphere

C. WHREN Fellowships: Funding graduate students across the continent to support advancing research with the network resources.

D. Next WHREN Meeting: Establishing a time to continue dialogue on a Hemispherical agenda for cooperation

September: Received cross connect costs from DANTE

After a three-week delay, RNP was able to get from DANTE the contract price for a cross-connect. The price is 2.326 Euros NRC, and a 538 Euro MRC. Again, RNP and CLARA stated they had no budget available for the cross-connect between their networks and the exchange in Sao Paulo. The WHREN awardees again agreed to pay the costs for one year until the long-term funding source can be established. From the receipt of the quote until the letter of authorization of charges took 48 hours. The order then took another two weeks to be placed through Dante and Global Crossing. This resulted in a three week delay on the original 45 day time line.

November: Establish 2.5Gb/s Miami-SP Link
In cooperation with Latin American Nautilus, on November 1st the connectivity from Miami to Sao Paulo was upgraded to 2.5 Gb/s. This requires port changes, which ANSP paid the $12,000 charge. While originally provisioned at STM-16, the ANSP equipment was unable to channelized, and thus the connection had to be dropped to STM-4. ANSP paid the port change fee for that as well.

November: Peering with RNP at LILA East
With coordination from LAN in Argentina at IMPSAT's headquarters, the cross connection between the DANTE rack and the WHREN space in Cotia was successfully made. The fiber was lit and provisioned with 1 Gb/s service, matching the RNP back-bone. This connectivity allowed Alberto Santoro (in Rio) to participate in the bandwidth challenge at Super Computing 2005. RNP has had problems addressing routing issues with this link, its Clara links to Tijuana and Argentina, and its Clara link to Europe. All of which have routing paths to destinations in the U.S. They are working on resolving the asymmetrical routing problems. This results in every R&E network on the East Coast peering with LILA.

November: Super Computing Demonstration
The WHREN/LILA project participated in the Ultralight SC demonstration. Two high energy physics groups, one in Sao Paulo and one in Rio utilized the link bursting to 2.5Gb/s. This was an extraordinary accomplishment within Brazil, joining together two previously disparate groups. It involved round-the-clock work from engineers at ANSP, FIU, RNP and Caltech to make the demo a success.

December: ONS released from Customs
The ONS was released from Customs on November 28th. The machine is DC powered. As such, ANSP engineers are locating a converter to configure final details of the machine. Rack space is being made at Cotia and the ONS will be operational in the open exchange before the end of the year, allowing all networks who would like to peer an attractive new option. RNP proposed the following configuration that is being adopted:

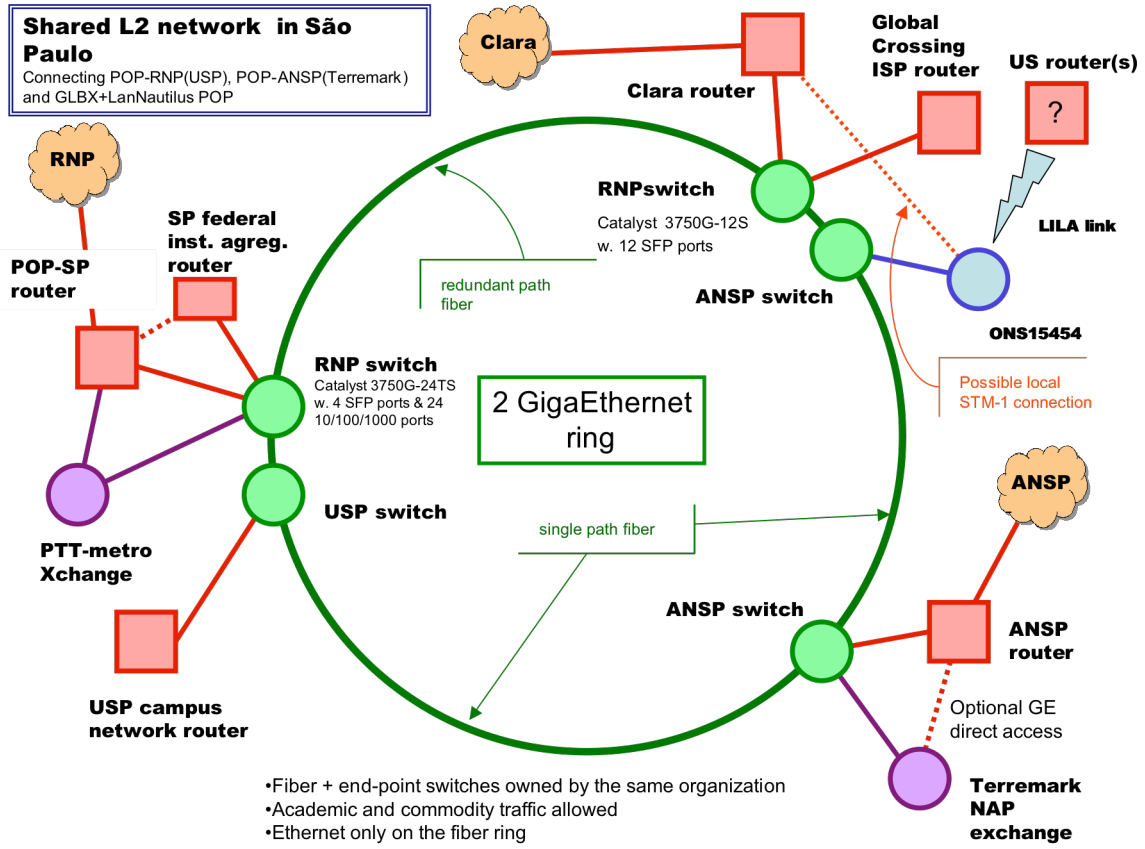

Figure 6 Shared L2 Network in Sao Paulo, Brazil

5. Progress Reports

The following sections detail progress against the NSF IRNC cooperative agreement milestones

5.1 Year 1

a) Establish LILA West between San Diego and Tijuana

ACTION: 1Gb/s in operation.

b) Establish LILA East between Miami and Sao Paulo

ACTION: Link evolve from 622mb/s to 2.5 Gb/s to eventually return to 1.2 Gb/s

c) Implement monitoring and measuring mechanisms

ACTION: MonALISA and Cricket monitoring used. Awaiting further information from the SGER awardees on monitoring and measurement.

d) Established WHREN proposed peerings: RedClara, CUDI, ANSP and RNP

ACTION: Peering through the East Coast LILA distributed exchange points is ANSP(Brazil), RNP(Brazil), RETINA(Argentina), and CNTI(Venezuela). Through the West Coast LILA exchange points are CUDI(Mexico) and CLARA(DANTE/Latin America Regional). CLARA is providing transit for REUNA (Chile), RNP(Brazil), SENACYT (Panama) and Peru. RNP is inconsistently peering at LILA East as they resolve technical peering issues. While all East Coast countries in Latin America are members of CLARA, they have elected to maintain direct network connections due to uncertainty of CLARA funding (set to expire in Spring 2005, but granted a No cost extension from the European Union).

e) Create IRNC peering points to support open exchange

ACTION: Open exchange points established. AURA connected directly to open exchange LILA East, and planning potential 10Gb/s connection to LILA West for LSST.

f) Instantiate WHREN governance

ACTION: Held first WHREN meeting, established priorities:

A. Western Hemisphere Conference: A PRAGMA like applications focused meeting uniting researchers across the Western Hemisphere

B. Web Forum for communication: Establishing an XML-based central site that draws from all the RENs in the Western Hemisphere

C. WHREN Fellowships: Funding graduate students across the continent to support advancing research with the network resources.

D. Next WHREN Meeting: Establishing a time to continue dialogue on a hemispherical agenda for cooperation

g) Augment IRNC support through proposed industrial partnerships

ACTION: Collaborated with Cisco on Supercomputing 2005. Sustained 2 gb/s traffic from Brazil to Seattle.

h) Participate in U.S. - Latin American existing, and developing network planning

ACTION: Participated in Clara, ANSP, and RNP planning meetings

i) Provide Spanish and Portuguese translations of key material

Action: Awaiting approval of first year reports.

5.2 Year 2 Proposed Actions

a) Operate LILA between San Diego and Tijuana

Ensure operational (as defined by CPO) availability of the link, Foster effective peering with international and domestic research and education networks.

b) Operate and Upgrade LILA between Miami and Sao Paulo

Ensure operational (as defined by CPO) availability of the link. Foster effective peering with international and domestic research and education networks. Increase capacity of link from 1.2 Gbps to 1.8 Gbps in support of application need outlined in WHREN proposal.

c) Monitor and measure links

Monitor, measure, and report on utilization of LILA links to satisfy requirements described in section 7. Utilize REU support to develop and improve monitoring and measuring tools.

d) Facilitate WHREN governance

WHREN governance meetings will be held annualy to ensure broad participation in ongoing planning. Management committee meetings will be held as defined in the WHREN proposal. Cognizant NSF program officers will be given 4 weeks notice of annual meetings and invited to participate.

e) Augment IRNC support through proposed industrial partnerships

In order to progress towards more efficient and economical U.S.-Latin American connectivity, technology transfer of operation of unprotected circuits will occur through structured joint engineering events. These joint engineering events will be made known to the NSF, and the results will be included in documentation provided. The metric of success is lowering the cost of bandwidth from the U.S. to Latin America.

f) Participate in U.S. - Latin American existing, and developing network planning

Participate in regional and national Latin American research and education network planning and development activities. These activities will be documented, with success defined as new U.S. collaborations supported through additional network infrastructure.

g) Provide Spanish and Portuguese translations of key material

Foster community building though the creation of a multi-lingual web site within 30 days of award. This site will be a repository for all NSF approved ad-hoc, monthly, quarterly, and annual reports. All reports will be available in English, Spanish and Portuguese within 10 days of NSF approval.

h) Edit the year 3 program plan as directed by the NSF.

6. Outreach

1. The WHREN-LILA web site was established at http://www.whren-lila.net

2. Both a LILA and a WHREN kick-off meeting were held.

3. Organized an NSF-sponsored workshop on Cyberinfrastructure for International Biodiversity Research Collaboration. The workshop takes place in Panama, January 10-13, 2006. http://www.ciara.fiu.edu/biocyber/index.htm.

> The workshop brings together domain scientists, practitioners, policy makers and funding agency representatives to discuss the issues and challenges to build and sustain the technology infrastructure needed for international biodiversity research collaborations. The workshop will focus on identifying activities that will enable North and Central American partnerships, with an eye toward a more inclusive western hemisphere approach. Outcomes will include recommendations for follow-on activities and suggestions for investments to promote international informatics collaborations.

4. The following newsletters were distributed to the community:

WHREN Monthly Report
Volume 1, Issue 1
June 8, 2005

The Western Hemisphere Research and Education Networks (WHREN) monthly report summarizes activities from participating networks. The WHREN Monthly Report is published under National Science Foundation (NSF) Award # 0441095 and Academic Network at São Paulo (ANSP) award Projeto Fapesp no. 04/14414-2.

June 2005 Issue:

1. From the Desk of Julio Ibarra
2. Historic Meeting Launches a New Era of International Research Collaboration in the Americas
3. FIU-AMPATH Activities
4. CENIC Activities
5. Pacific Wave Activities
6. CLARA Activities
7. CUDI Activities
8. ANSP Activities
9. AtlanticWave Activities
10. REUNA Activities
11. RNP Activities
SUBSCRIPTION INFORMATION

****
NEWS

****

1. From the Desk of Julio Ibarra

This inaugural newsletter of the WHREN-LILA project marks the beginning of a holistic vision for research and education interconnections in the Western Hemisphere. New network connections supporting the advancement of science and engineering research and education in the western hemisphere are underway. I believe that scholarship in the Americas will improve through new opportunities for collaborative teaching, technology-augmented student mobility, and an infrastructure for inquiry-based learning.

Along with CENIC, my institution, FIU, is working with peer organizations from the U.S. and Latin America that serve the science, research and education communities in the western hemisphere. FIU and CENIC, along with peer organizations the Academic Network of São Paulo (ANSP), the Cooperation of Latin American national research and education networks (CLARA), the national research and education network of Brazil (RNP) and the national research and education network of Mexico (CUDI), have formed a collaboration that will interconnect the research and education networks of the western hemisphere. In particular, our connection to the RedCLARA network already allows US researchers to reach 7 countries in Latin America an additional 11 Latin American countries by the end of 2005.

2. Historic Meeting Launches a New Era of International Research Collaboration in the Americas

The kickoff meeting of the project, the Western-Hemisphere Research and Education Networks – Links Interconnecting Latin America (WHREN-LILA), was held on April 30, 2005, in Veracruz, Mexico. This project is made possible by a grant from the National Science Foundation (NSF), award #0441095 and an award from FAPESP #2003/13708-0

Representatives of Florida International University (FIU) and CENIC, the NSF awardees, as well as representatives of Brazil (RNP), the State of Sao Paulo (ANSP), Mexico (CUDI), Argentina (RETINA) and the regional Association of Latin American Research Networks (CLARA) launched the capability for network-mediated science and engineering research and collaborations between the United States and Latin America, on a par with those with Europe and Asia. This project creates high-speed networking connections between the U.S. and Latin America.

The LILA connections along with a partnership with RedCLARA, a regional research network covering Latin America, offer researchers connectivity to a high-speed international peering network throughout the Western Hemisphere. This allows the U.S. to contribute to and leverage Western Hemisphere network initiatives in a way that has previously been impossible. This hemispheric vision creates a framework that establishes a foundation to support the needs of interregional science and education. While LILA serves to link interregional networks, specific domains that wish to provision dedicated or committed bandwidth have both the benefit of the LILA connections and the WHREN management organization.

3. CENIC ACTIVITIES

The Corporation for Education Network Initiatives in California is charged with designing, provisioning, and operating robust, high-capacity, next-generation Internet communications services through a cohesive infrastructure for its associates and affiliates. CENIC represents the common interests of its associates, who are drawn from California's higher education academic and research communities, and is highly accountable to the institutions it serves to fulfill the trust that has been placed with it. CENIC also provides services to California K-12 schools and, to facilitate the education and research mission of its associates, to non-California higher education institutions and industry research organizations with which CENIC associate researchers and educators are engaged. See www.cenic.org

4. CUDI ACTIVITIES

On April 1999, a private corporation was formed to implement and fund the University Corporation for Internet Development in Mexico (CUDI A.C.). CUDI A.C. is a not-for-profit organization, committed to the development, use, and support of advanced networks and wide-band connectivity applications for education and research. Today CUDI provides connectivity to more than 98 academic institutions and research centers. This represents approximately 66% of the students in the Mexican higher education system and 80% of research centers.

More information on CUDI can be found at www.cudi.edu.mx

5. ANSP ACTIVITIES

ANSP unites São Paulo's University networks with Scientific and Technological Research Centers in São Paulo, and is managed by the State of São Paulo Research Foundation (FAPESP). The ANSP Network is another example of international collaboration and exploration. Through its connection to AMPATH, all of the institutions connected to ANSP will be involved in research with US universities and research centers, offering significant contributions and the potential to develop new applications and services. This connectivity with AMPATH and ANSP will allow researchers to enhance the quality of current data, inevitably increasing the quality of new scientific developments, www.ansp.br.

6. FIU-AMPATH ACTIVITIES

Florida International University is one of America's most dynamic institutions of higher learning. Since opening in 1972, FIU has achieved many milestones of excellence that have taken other universities more than a century to reach, including its classification as a Research I university. FIU has a nationally renowned faculty known for their outstanding teaching and cutting-edge research, and various students from the U.S. and over 130 foreign countries attend FIU each year. FIU operates the AMPATH International Exchange Point in Miami for peering of international R&E networks of the Americas. The AMPATH international exchange point is located at the NAP of the Americas in Miami. AMPATH is supported in part by grants from the National Science Foundation.

More information about AMPATH can be found at www.ampath.fiu.edu. The university offers more than 200 Baccalaureate, Master's and Doctoral degree programs in 16 colleges and schools. For more information on Florida International University, please visit www.fiu.edu.

7. ATLANTICWAVE ACTIVITIES

AtlanticWave is an international distributed exchange and peering service along the Atlantic rim of North and South America. It will facilitate open exchange and peering services for the national and international networks that interconnect at international exchange points MANLAN in NYC, MAX in Washington DC, AMPATH in Miami, and ANSP (the Academic Network of Sao Paulo) and RedCLARA (Cooperação Latino-Americana de Redes Avançadas – Latin American Cooperation of Advanced Networks) in Sao Paulo.

The current A-Wave partnership consists of SURA, the Internet Educational Equal Access Foundation (IEEAF), MANLAN, Mid-Atlantic Crossroads (MAX), Southern Crossroads (SoX)/Southern Light Rail (SLR), Florida Light Rail (FLR), AMPATH, the Academic Network of Sao Paulo (ANSP), and CLARA. The planned points of interconnection for the AtlanticWave are NYC/MANLAN, DC/MAX, SoX, AMPATH and ANSP/Sao Paulo, creating an open distributed exchange spanning the Atlantic Rim from NYC to Sao Paulo.

8. PACIFIC WAVE ACTIVITIES

During April, Pacific Wave brought up the 10 gigabit connection to APAN/TRANSPAC in Los Angeles. We also completed the testing period for the NII/SuperSinet gigabit connections in Los Angeles.

Ultralight's connection to Pacific Wave via Caltech's High Energy Physics group was moved from a CENIC port to its own 10 gigabit port. Now participants can directly peer with them.

The Pacific Wave engineering group constructed a new 1500 MTU VLAN for those participants who are not quite ready to move to the 9000 MTU jumbo frame VLAN in use by the majority of participants.

Visit the Pacific Wave website at http://www.pacificwave.net/.

9. REUNA ACTIVITIES

Nothing to report

10. RNP ACTIVITIES

Nothing to report

SUBSCRIPTION INFORMATION

The WHREN newsletter is intended to provide useful, up-to-date information about WHREN through short articles with web links and email addresses. Newsletters will be posted on the WHREN website (whren.ampath.net). If you have colleagues who would like to subscribe to this monthly newsletter, send them to: http://www.ampath.net/mailman/listinfo/whren-today.

If you would like to be removed from the WHREN Monthly Report mail list, you may unsubscribe at: http://www.ampath.net/mailman/listinfo/whren-today.

WHREN-LILA Report
Volume 1, Issue 2
September 23, 2005

The Western Hemisphere Research and Education Networks (WHREN) - Links Interconnecting Latin America (LILA) report summarizes activities from participating networks. The WHREN-LILA Report is published under National Science Foundation (NSF) Award # 0441095 and Academic Network at São Paulo (ANSP) award Projeto Fapesp no. 04/14414-2.

September 2005 Issue:

1. From the Desk of Julio Ibarra
2. FIU-AMPATH Activities
3. CENIC Activities
4. Pacific Wave Activities
5. AtlanticWave Activities
6. CLARA Activities

SUBSCRIPTION INFORMATION

****
NEWS
****
1. From the Desk of Julio Ibarra

It's been an extremely busy summer for the WHREN-LILA project team. Just ninety days after a great kickoff meeting in Veracruz, both parts of Phase 1 are operational. Phase 1 involves establishing the LILA links from (1) San Diego to Tijuana, and (2) Miami to Sao Paulo.

The west coast LILA dark fiber link between San Diego and Tijuana was successfully installed. A single Gigabit Ethernet wave is now in service that connects redCLARA and CUDI to California's CalREN network. Effective July, CUDI and CLARA are successfully peering with Internet2's Abilene network.

The east coast LILA link was initially provisioned as an STM-4 circuit between Miami and Sao Paulo. This is an interim solution that was made available by ANSP with the use of their equipment. This will be in place until the project's permanent equipment is located in the Sao Paulo open exchange. We are very grateful to ANSP for the generous use of their equipment. Also

effective in July, ANSP is peering with Abilene via the AMPATH International exchange in Miami. Work is underway to connect RedCLARA and RNP to the Sao Paulo open exchange where they will be able to use the LILA link to peer with the wide array of research and education networks already present at the AMPATH exchange point. The AMPATH exchange fabric will be extended even further in the coming months as the AtlanticWave, a distributed peering fabric from Miami to New York. This benefit will be immediately available to peers at the Sao Paulo open exchange.

2. FIU-AMPATH Activities

Nothing new to report.

3. CENIC ACTIVITIES

The new fiber-based link between Tijuana and CENIC's CalREN network hub site in San Diego became operational in early July. Supporting one Gbps connectivity initially, the installation was a cooperative effort of participants from CUDI, CLARA and CENIC. The link uses fiber acquired from Global Crossing and CENIC optical and ethernet switch equipment.

The link was inaugurated in a ceremony that occurred on Thursday, July 14, at the Border Governor's meeting at Torreon in the Mexican State of Coahuila. Jim Dolgonas, President of CENIC, participated in the event as did Dr. Eric Frost from San Diego State University. Dr. Frost is a participant in the University of California's CalIT2 research institute. Participation occurred via the network, using H.323 IP-based video teleconferencing, from San Diego State and CENIC's Cypress offices respectively, and using the just installed fiber network connection. Among the participants in Torreon was California's Governor Arnold Schwarzenegger.

An example of this new connection's benefit will be realized through the University of California's College Preparation (UCCP) program. UCCP has developed a collection of online high school and advanced placement courses that utilize streaming video and interactive simulations to help students succeed in difficult subjects like Algebra and Calculus. The University of California system has agreed to share the online math courses with Mexico, and Mexican educational institutions will translate the courses into Spanish and will make the translations available to students in California.

More information on CENIC can be found at www.cenic.org.

4. PACIFIC WAVE ACTIVITIES

Pacific Wave is a project of the Corporation for Education Network Initiatives in California (CENIC) and the Pacific Northwest Gigapop (PNWGP), with participation from the University of Southern California and the University of Washington. Designed to enhance efficiency of IP traffic, Pacific Wave peering services offer excellent opportunities to pass IP traffic directly with other major national and international networks; reduce costs associated with IP traffic that would otherwise transit commercial carrier circuits; and increase efficiency by directing traffic as

quickly as possible to the target network/organization, reducing the number of 'hops' required to complete for the data to get to its destination.

Pacifc Wave consists of six node sites: one in Seattle, Washington, three in Los Angeles, California and most recently one in Sunnyvale, California. Another site in Palo Alto is due to become active some time in 2005. New participants during this period are: ESnet in Sunnyvale, MIMOS Berhad in Los Angeles, SingAREN in Los Angeles and Pacific Interface (CINEGRID), also in Los Angeles.

In conjunction with the GLORIAD network implementation, KREONet2 has upgraded its trans-Pacific circuit to OC-192 and its connection to Pacific Wave in Seattle to 10GbE.

The Pacific Wave facility is gearing up for the forthcoming iGrid 2005 event Sept. 26-30th at CalIT2 at the University of California at San Diego. iGrid 2005 is a coordinated effort to accelerate the use of existing multi-10 Gbps international and national networks, to advance scientific research, and to educate decision makers, academicians and industry researchers on the benefits of these hybrid networks. R&E networks from Europe, Pacific Rim, Australia, and North America (and South America) will be making use of the Pacific Wave facility in support of high-bandwidth applications and demonstrations for this event.

For more information visit the Pacific Wave website at http://www.pacificwave.net/. The site is undergoing a reconstruction so check back in September and October for a new look.

5. ATLANTICWAVE ACTIVITIES

Nothing new to report.

6. CLARA Activities

The first direct connection between RedCLARA and the academic networks of the United States of America was established. The new link, with a capacity of 1Gbps, connects Tijuana (Mexico) with San Diego (California, USA), allowing direct access between the Latin American network and CALREN, California's academic network.

The traffic exchange agreement between RedCLARA and the main backbone of Internet2, Abilene, has been confirmed. This will make the process of networking between Latin America and the USA easier.

The connection of RedCLARA to USA was done under the WHREN/LILA project. WHREN/LILA will create another connection between CLARA and Internet2, between São Paulo (Brazil) to Miami (USA). This last connection will be shared between CLARA, RNP and the academic network of São Paulo, ANSP.

For more information on RedCLARA, visit http://www.redclara.net/.

SUBSCRIPTION INFORMATION

The WHREN-LILA newsletter is intended to provide useful, up-to-date information about WHREN-LILA through short articles with web links and email addresses. Newsletters will be posted on the WHREN-LILA website (www.whren-lila.net). If you have colleagues who would like to subscribe to this monthly newsletter, send them to: http://www.ampath.net/mailman/listinfo/whren-today.

If you would like to be removed from the WHREN-LILA Monthly Report mail list, you may un-subscribe at: http://www.ampath.net/mailman/listinfo/whren-today.

WHREN-LILA Report
Volume 1, Issue 3
November 21, 2005

The Western Hemisphere Research and Education Networks (WHREN) - Links Interconnecting Latin America (LILA) report summarizes activities from participating networks. The WHREN-LILA Report is published under National Science Foundation (NSF) Award # 0441095 and Academic Network at São Paulo (ANSP) award Projeto Fapesp no. 04/14414-2.

November 2005 Issue:

1. From the Desk of Julio Ibarra
2. FIU-AMPATH Activities
3. CENIC Activities
4. Pacific Wave Activities
5. AtlanticWave Activities
6. RNP Activities
7. REUNA Activities
8. ANSP Activities

SUBSCRIPTION INFORMATION

****
NEWS
****

1. From the Desk of Julio Ibarra

There has been a lot of activity since our last newsletter. WHREN links were used at both the iGrid 2005 meeting in September and SC|05 in November. These venues provided a showcase for demonstrations using WHREN.

At iGrid 2005, two different demonstrations used WHREN. The bandwidth available for the demos was 622 MB/sec. The first was a demonstration and presentation on “Opening a University Fiber Highway Between Mexico and the US”, which used the link between San Diego and

Tijuana. This project is a collaboration between San Diego State University in the US and CUDI, CONACYT and CICESE in Mexico. More information on this project can be found at http://igridmx.cicese.mx/. To view performance monitoring of the demo, go to: http://www.whren-lila.net/network/igrid05-sdtj.htm

The second iGrid 2005 demo using WHREN involved the link to Brazil. "Global Lambdas for Physics" demonstrated the "Grid Analysis Environment" which enables physicists to do on-demand network and resource provisioning for event analysis from desktops. To view performance monitoring of the demo, go to http://www.whren-lila.net/network/igrid05-brazil.htm

At SC|05, three Brazilian universities participated in the bandwidth challenge, Universidade do Estado do Rio de Janeiro (UERJ), Universidade Estadual Paulista (UNESP) in São Paulo and Universidade de São Paulo (USP), using the WHREN link. The WHREN link was able to be set at 2.5 GB/sec, allowing Brazil to fully participate in the challenge. For more information on the bandwidth challenge, visit http://www-iepm.slac.stanford.edu/monitoring/bulk/sc2005/hiperf.html.

Also, since the last newsletter, RNP is now connected in São Paulo. Now, both ANSP & RNP are connected and peering with Abilene through Miami. Other good news is that the equipment that was stuck in customs in Brazil has been released. This equipment will serve as an aggregation point for ANSP, RNP and CLARA to connect to the United States.

2. FIU-AMPATH Activities

Nothing new to report.

3. CENIC ACTIVITIES

Nothing new to report

4. PACIFIC WAVE ACTIVITIES

Pacific Wave facilitated some of the real-time demonstrations of technology at the recent iGrid 2005 conference held at CalIT2 at the University of California at San Diego in September. iGrid 2005 is a coordinated effort to accelerate the use of existing multi-10 Gbps international and national networks, to advance scientific research, and to educate decision makers, academicians and industry researchers on the benefits of these hybrid networks.

More regarding these demonstrations can be seen on the IGRID2005 website http://www.igrid2005.org/index.html. Projects that used Pacific Wave were:

Data Reservoir
http://www.igrid2005.org/program/applications/dataservices_datareservoir.html

International Real-time Streaming of 4K Digital Cinema
http://www.igrid2005.org/program/applications/videoservices_rtvideo.html

Global N-Way Interactive High-Definition Video Conferencing over Long-Pathway, High-Bandwidth Networks
http://www.igrid2005.org/program/applications/videoservices_nwayconf.html

20,000 Terabits Beneath the Sea: Global Access to Real-Time Deep-Sea Vent Oceanography
http://www.igrid2005.org/program/applications/sciservices_terabitssea.html

Currently, Pacific Wave is busy helping exchange participants setup their demonstrations for the Supercomputing 05 Conference in Seattle, Washington. See http://sc05.supercomputing.org/ for information about the conference.

For more information visit the newly designed Pacific Wave website at http://www.pacificwave.net/.

5. ATLANTICWAVE ACTIVITIES

Nothing new to report.

6. RNP Activities

The Brazilian National Research and Education Network (RMP) is currently engaged in a nationwide program to upgrade the capacity of the communications networks used by the Education and Research institutions in the country. An essential component of this program is the deployment of metropolitan optical networks in the major population centers.

For more information on RNP, visit their website at http://www.rnp.br/

7. REUNA Activities

Positioning itself in the vanguard of third generation networks, on August 30 REUNA completed "Services and Applications Outposts on Third Generation Networks" projects. REUNA worked with the Austral University of Chile, University of the Border and University of Chile. Funding was thanks to Fondef and the support of the companies, Twin Storage Solutions and Global Crossing. The results of this project emphasize IPv6 as an important segment of the REUNA network, which allows any university to connect to the Academic Networks Outposts through Ipv6 in native form or channels.

Some of the results of the project were:
* Knowledge of the network equipment pertaining to REUNA2 and identifying the improvements necessary to support IPv6.
* Obtaining a Block /32 grant by LACNIC.
* Unfolding IPv6 in an important segment of the network and interconnection with International the Academic Networks.
* Benefit of services of tunnels IPv6 - Ipv4 with a model of management established for the universities members of the Corporation.

For more information on REUNA, visit their website at http://www.reuna.cl/

8. ANSP Activities

FAPESP, through its TIDIA (Information Technology in Advanced Internet Development) Program invited researchers, students and professionals of Information Technology and Communications related areas to the Second TIDIA Workshop, held at the Convention Center of Sírio Libanês Institute, November 7 through 9, 2005.

The workshop showcased lectures by renowned experts both from Brazil and abroad, as well as presentation sessions of technical works and an enterprise exposition. Groups participating in KyaTera, Electronic Learning and Virtual Incubator Projects presented their contributions to the TIDIA Program. For more information about the event, see http://www.tidia.fapesp.br/portal-en/events

KyaTera is a project under TIDIA program. It is denominated Kya, which in Tupi-guarani (Brazilian aboriginal language) means fishing net and Tera, from Greek, which means gigantic. Kyatera is a cooperative project consisting in an optical fiber network designed for the research and development of high speed connections, connecting research laboratories focusing on the study, development and demonstration of technology and applications on Advanced Internet. The proposal consisted on the assembly of a testbed aimed at researching into the Dense Wavelength Division Multiplexing (DWDM) terminology, a networks transmission terminology.

The network is based upon the concept of dark fibers reaching to the laboratories, what means an optical high speed network of Statewide scale, which will determine the beginning of a new Internet era is São Paulo State. Such network will provide easy laboratory access, geographically spread, for new technology testing and Internet applications development. In some years this should evolve into a stable network connected to the World Academic Internet, with high quality service and without tangible bandwidth limitation, available for researching and teaching in the State.

For more information about the KyaTera project, visit their website at http://www.tidia.fapesp.br/portal-en/I.projetos/kyatera

Appendix A: Measurement of WHREN-LILA Annual Traffic

A.1 LILA-East Link

Following are graphs gathered for the LILA East link produced by MRTG. The distribution in blue shows traffic out from Miami to Sao Paulo; the distribution in green shows traffic in to Miami from Sao Paulo. Due to several physical hardware configuration changes the graphs are not continuous.

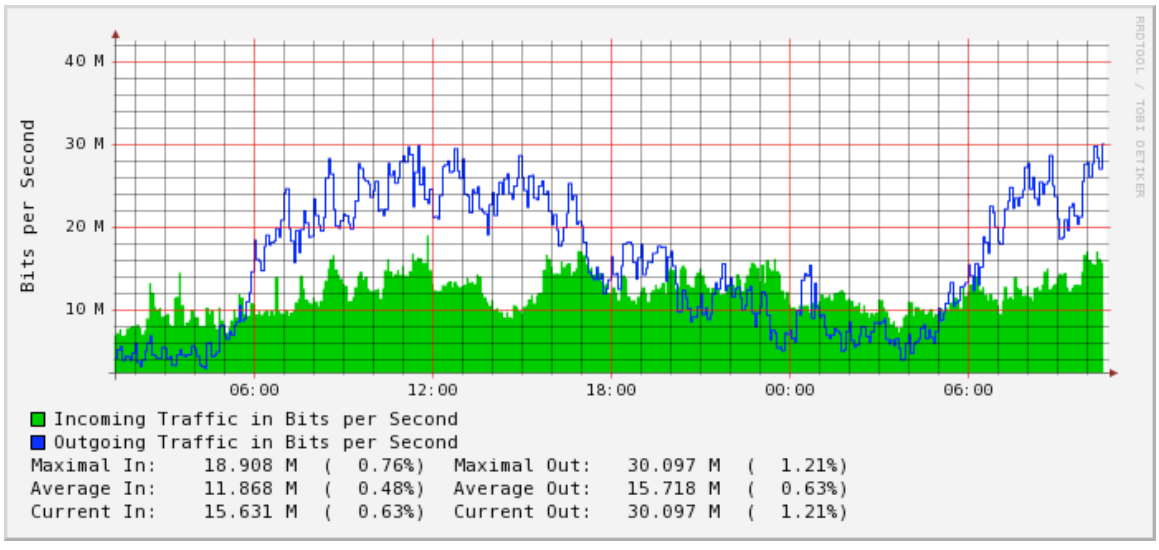

Figure 7 Daily Graph (5 Minute Average) - 12/13/2005

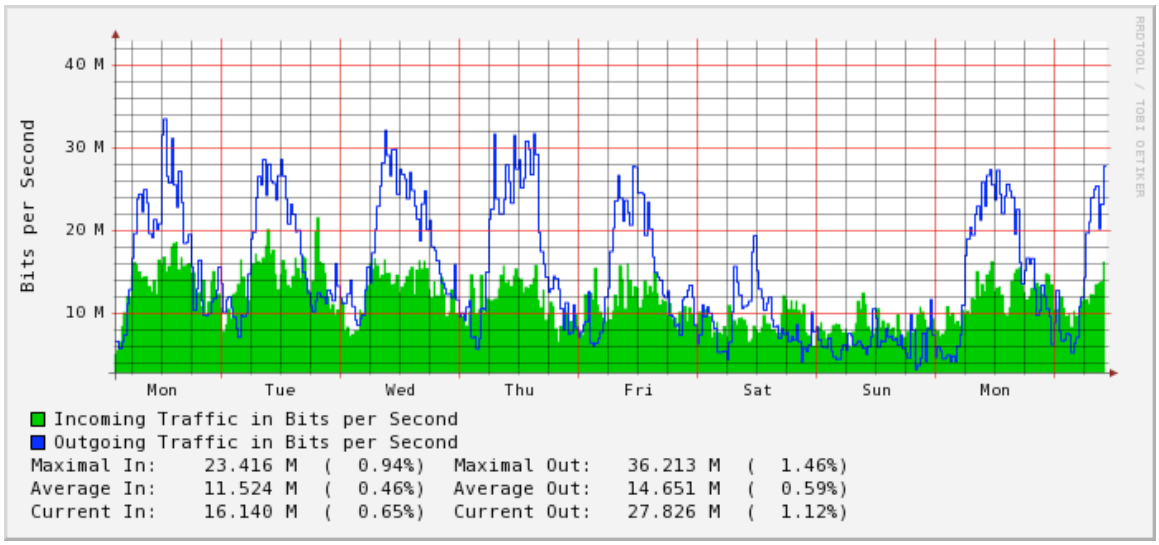

Figure 8 One Week Graph (30 minute average)

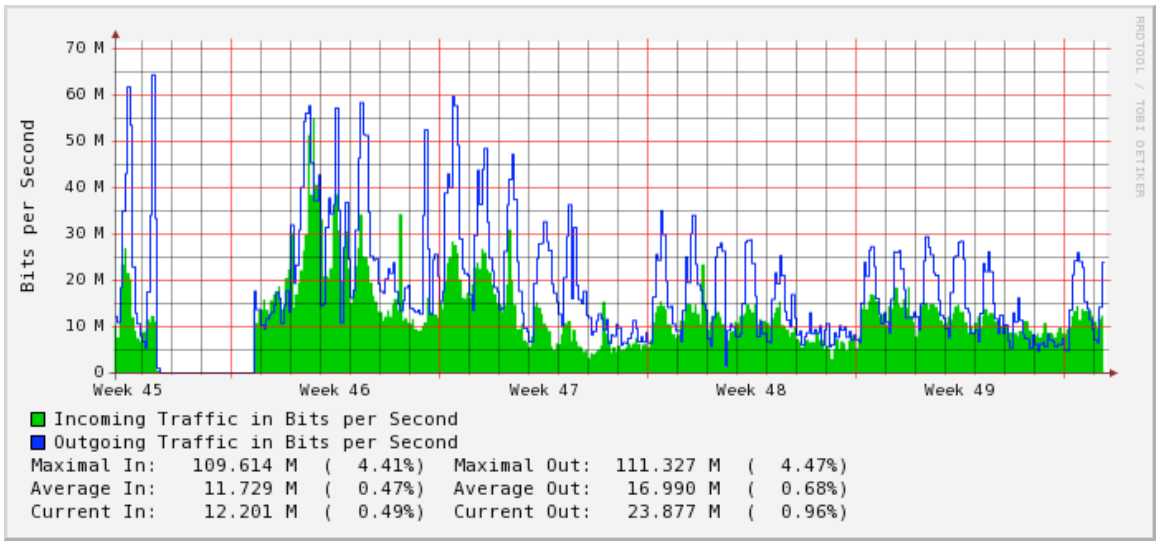

Figure 9 Weekly Graph (2 Hour Average)

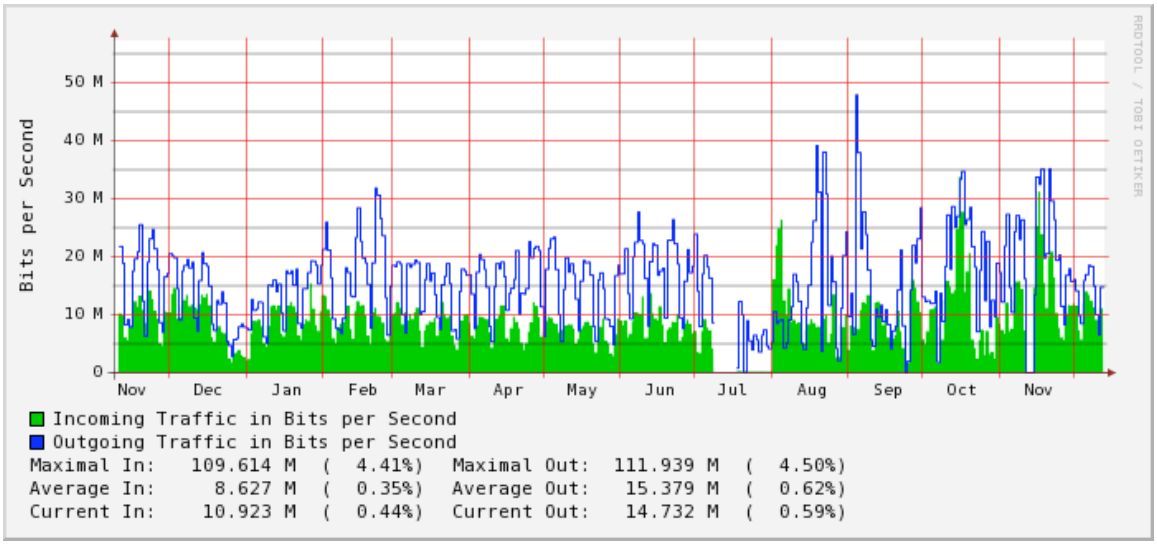

Figure 10 Yearly Graph (1 Day Average)

A.2 LILA-West Link

Following is measurement data for the LILA-West link between San Diego and Tijuana. The chart that follows shows link utilization from networks connected to CUDI, Mexico's NREN and RedCLARA, Latin America Regional backbone. Results are from data collected from July to December 2005. The bandwidth utilization tool used by CENIC, Cricket, presents maximum usage values for multiple time periods. Collection and calculation of Monthly and quarterly data are as follows:

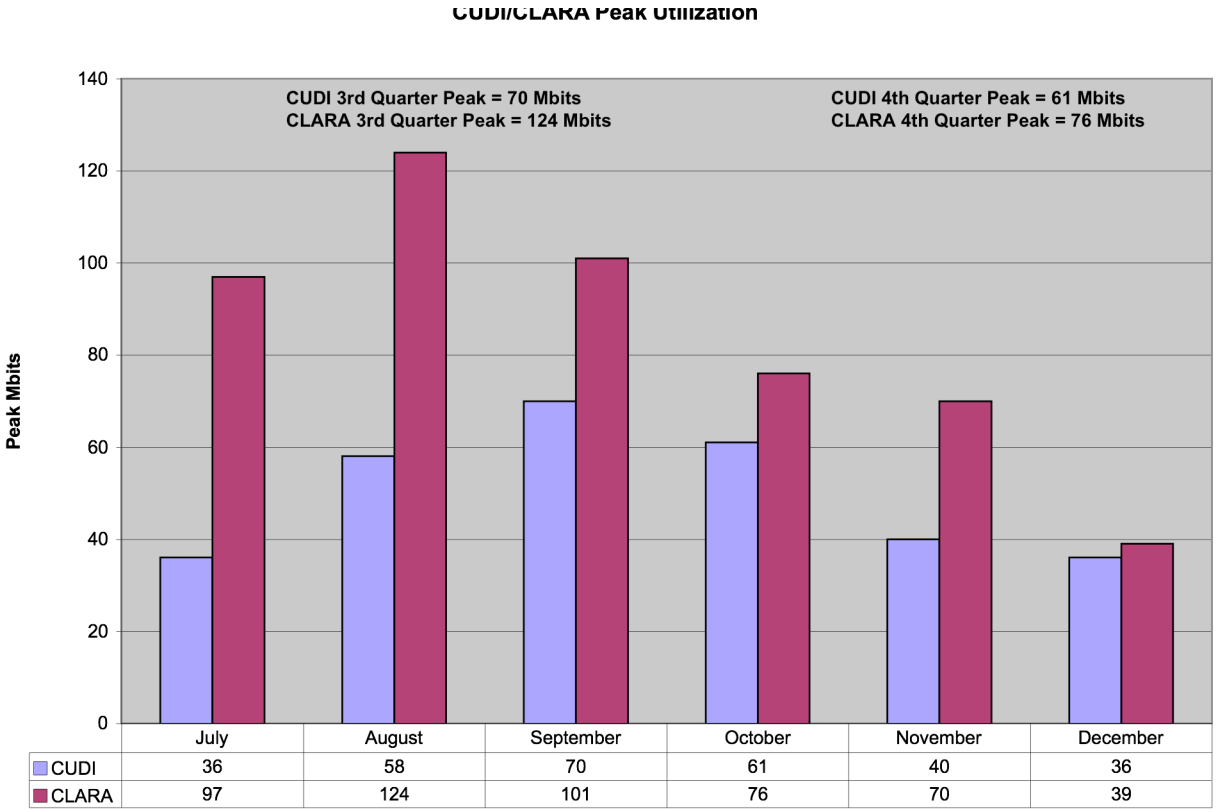

Figure 11 CUDI/CLARA Peak Utilization

Information presented as maximum monthly values is collected every 2 hours. The highest polled value during the 2 hour period is saved. The highest 2 hour value is extracted from the monthly reporting period and displayed. Information presented as maximum Quarterly values is representing the maximum value found from the monthly values for a three-month period.

Appendix B Super Computing 2005

Utilizing the WHREN-LILA East link, Brazil's high-energy physics groups in both Rio and Sao Paulo participated in the SC05 Bandwidth Challenge test. Brazil is a member of the CMS collaboration and operates and Tier2 facility in Rio and a Tier3 facility in Sao Paulo. Brazil was a member of a large international collaboration led by Caltech. Traffic to and from Brazil transited the UltraLight research network that interconnects in Miami with the WHREN-LILA link to Latin America. Following is the graph showing the actual bandwidth challenge taking place between 02:00 and 04:00.

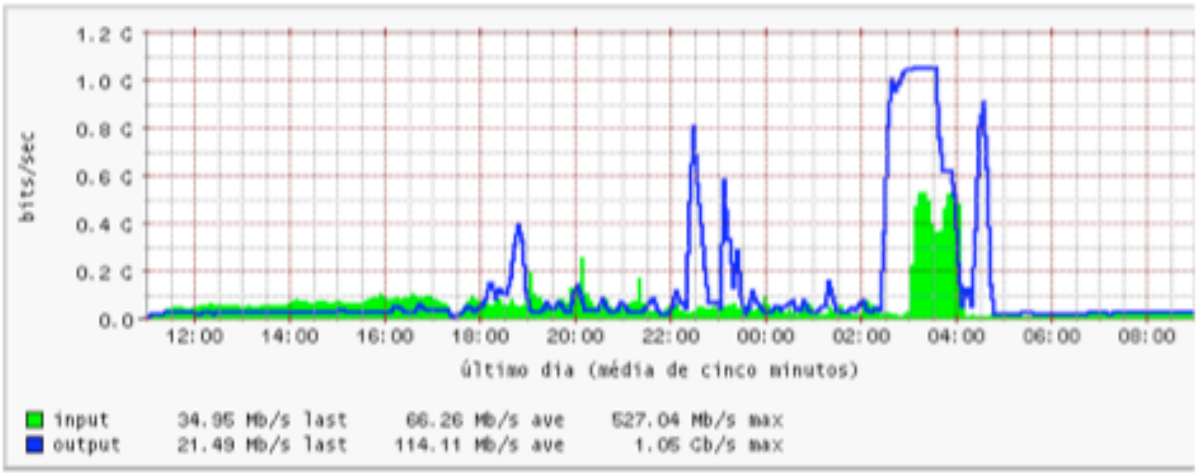

Figure 12 SC05 Bandwidth Challenge utilization over WHREN-LILA link to Sao Paulo

Using the MonALISA networking monitoring tool set, the following figure shows a graphical representation of the sites connected to the U.S., participating in the SC05 bandwidth challenge.

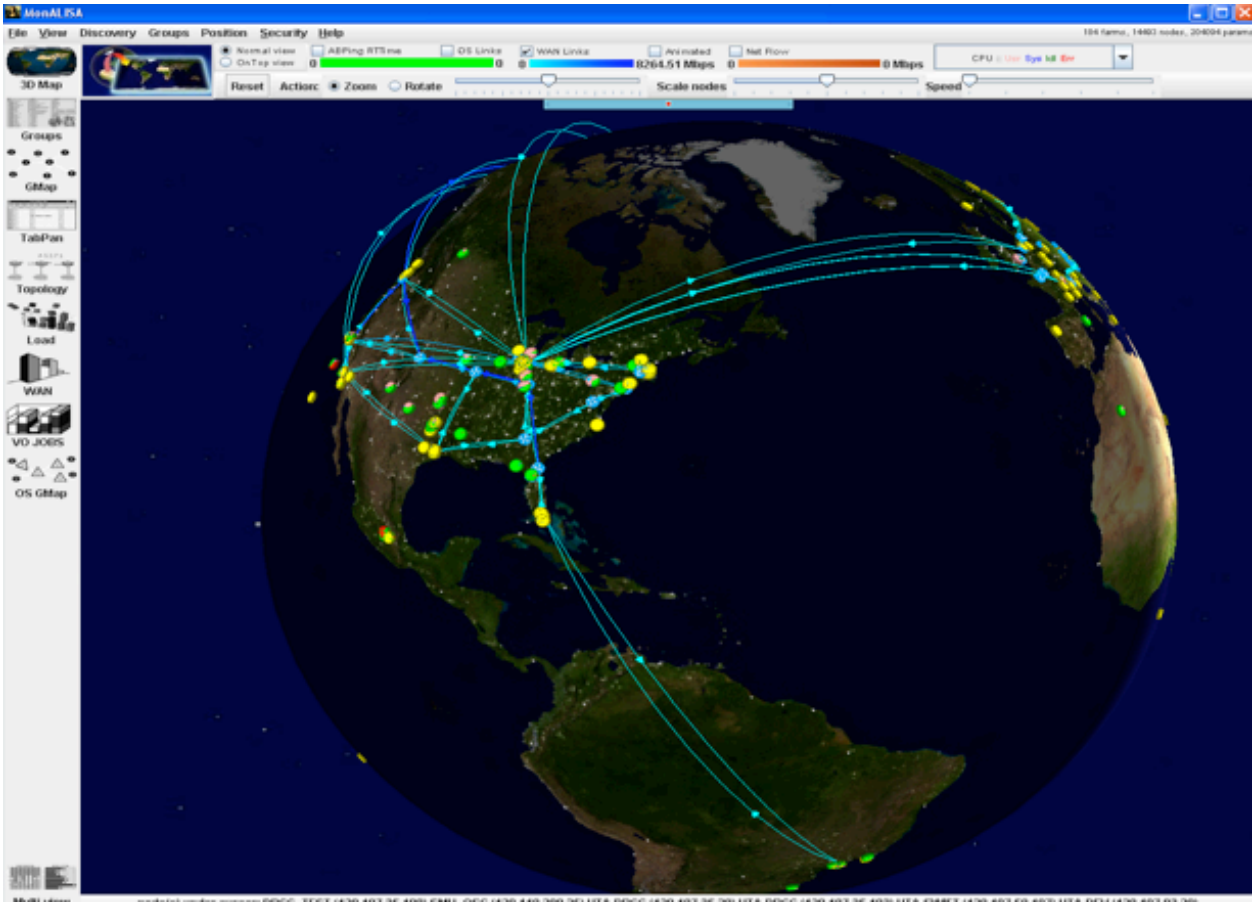

Figure 13 Sao Paulo and other sites participating in SC05 Bandwidth challenge

Appendix C WHREN/LILA NOC Annual Report, 2005

The Indiana University Global Research Network Operations Center (Global NOC) Service Desk provides operational services for AMPATH, the Abilene Internet2 network, TransPAC, STAR TAP, Euro-Link, and the Indiana University network. The IU Global NOC operational model is fully integrated within its existing 24/7 support structure. Designated NOC staff positions funded by these external networks comprise the primary support group for the various networks. Additional support is available from all NOC staff, regardless of network funding, as needed. Separate external identities, support mechanisms, and NOC Web pages are maintained for each network. The cross-functional nature of Global NOC services to AMPATH, Abilene, TransPAC, and STAR TAP allows these services to be dynamic and efficient.

Housed at the Indianapolis campus, the IU Global NOC tier-one service desk is staffed by twelve full-time employees. They work in conjunction with the AMPATH engineering staff who provide primary services, and the IU engineering staff, who provide back up engineering support.

The AMPATH NOC provides the following general NOC services:

- Problem Management (detection, tracking, and resolution of network problems)
- Change Management (notification and control of changes to the network)
- Performance Management (monitoring of network performance)
- Security Management (IU is a member of FIRST, the Forum of Incident Response Security Teams)
- Quality Assurance
- Reporting (regular reports supplied to all associated networks)
- Documentation

Critical to the NOC's function is the ability to manage the problem resolution cycle in the event of a network outage. The steps of this process are:

- Network alert (via monitoring tools or problem reporting mechanism)
- Identification
- Isolation
- Troubleshooting
- Escalation (to engineering staff, if necessary)
- Documentation and tracking (via trouble ticket system)
- Notification (to customer base)
- Vendor contact (if necessary)
- Continual tracking, documentation, notification, and assistance
- Problem resolution

- Reporting