(*Research and Education Network of São Paulo*)

SC25 NRE-128
High performance networking with Sao Paulo Backbone SP connecting 8 universities

GNG-A Community VCs Q4 2025

rednesp, funded by FAPESP
(The Sao Paulo Research Foundation)

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Research and Education Network of São Paulo

rednesp

rednesp (Research and Education Network of São Paulo), as defined in the decision of the Superior Council of FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo – Sao Paulo Research Foundation) when it was created, “provides the research community of the State of São Paulo with connectivity to computer networks in the state of the art".

rednesp develops and maintains Internet infrastructure and services and data communication in general that offers to the research and education community in the State of São Paulo the necessary technological means for accessing information worldwide, sharing knowledge, developing collaborative projects and large-scale innovation.

In 2020, and aiming at the institutionalization of the project on the initiative of FAPESP (**São Paulo Research Foundation)**, the coordination of the former ANSP began to be carried out by an executive committee linked to the Council of Rectors of State Universities of São Paulo (CRUESP), being then renamed rednesp (Research and Education Network of Sao Paulo).

FAPESP CIÊNCIA, CULTURA E DESENVOLVIMENTO

unesp

USP

UNICAMP

Research and Education Network of São Paulo

Intensive Sciences Working Group.

High performance networking with Sao Paulo Backbone SP connecting 8 universities

The research and education network of Sao Paulo (rednesp) connects dozens of research and education institutions in the State of Sao Paulo, Brazil also providing international connections to the USA and to Europe.

The addition of circuits connecting eight major research and education institutions with 100 Gbps links, providing connections to the USA and Europe for academic collaboration, has formed the so called “Backbone SP”.

"Backbone SP" provides lower latencies and higher bandwidth connecting major academic institutions in the State of Sao Paulo facilitating joint research efforts among these institutions. At the same time, the Ellalink provides lower latency between Brazil and Europe and thus open new opportunities for collaboration among Brazilian and European academic institutions.

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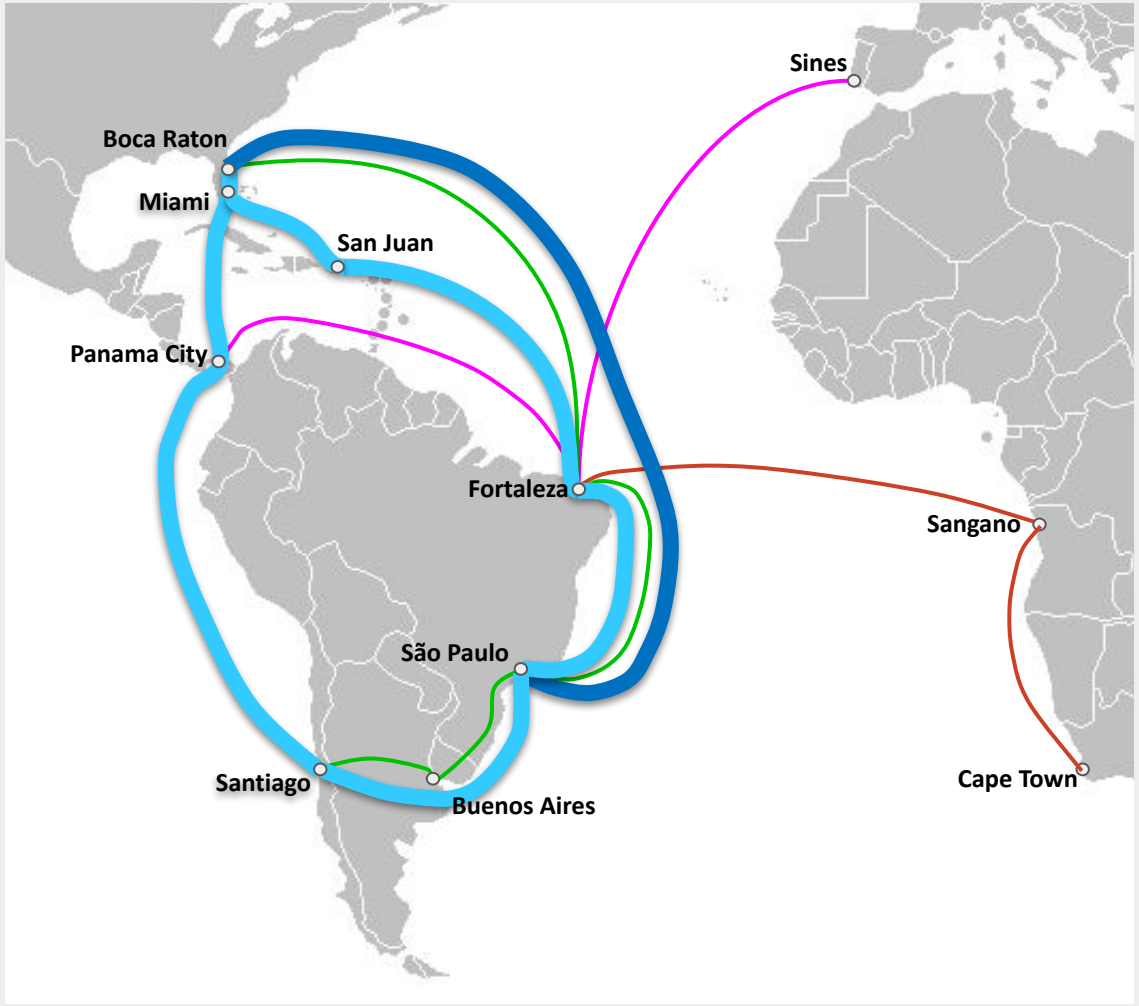
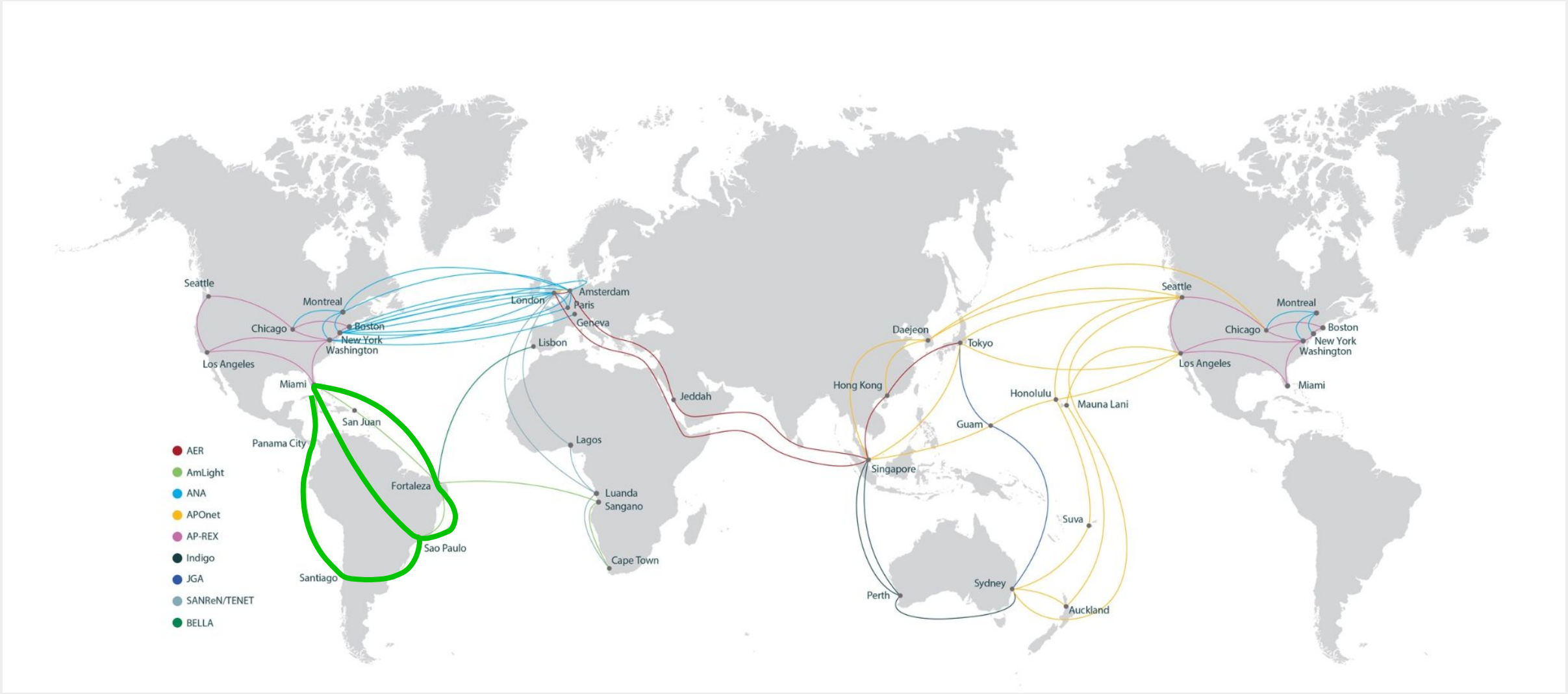
Amlight cooperation

Americas-Africa Lightpaths Express and Protected



- Co-responsible for managing the 100G ring between São Paulo - Miami – Santiago
- Allows rednesp to use a 100G lambda on Monet submarine cable
  - Part of the 1.1 Tb capacity from Amlight cooperation
  - Part of the network infrastructure to support the Vera Rubin Observatory
- Kytos-ng Project (SDN platform) collaboration

Global Network Advancement Group



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rednesp´s Backbone SP

The State of São Paulo accounts for 40% of Brazilian PhD's, and for 42% of the national production of scientific articles in indexed journals.

The BackboneSP project create a 100Gbps infrastructure to support the research and education in the State of São Paulo.

It is an alternative to connect research facilities and will be used to integrate HPC projects.

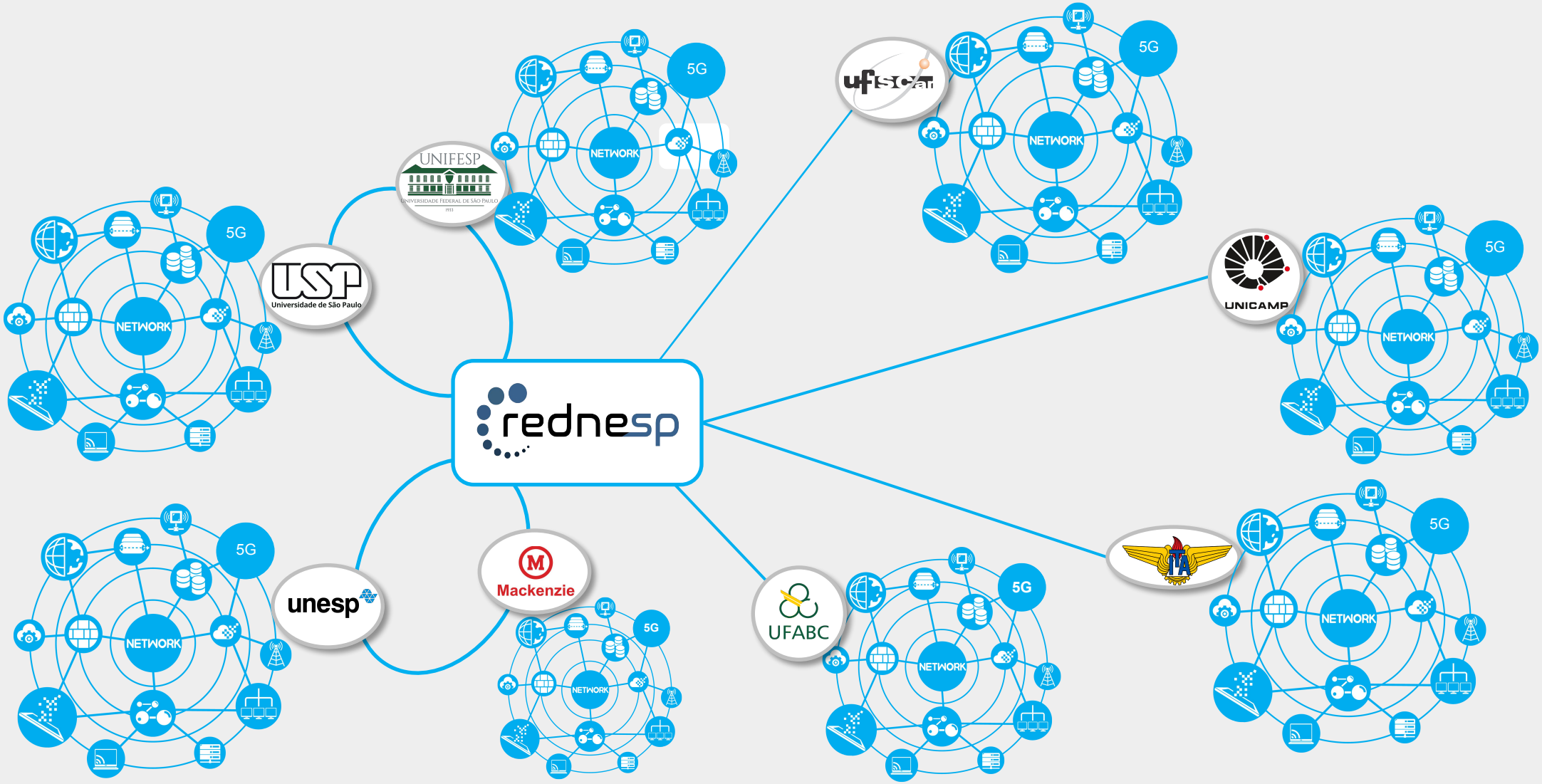
LNLS sirius — The Brazilian Synchrotron Light Laboratory

In 2025 we included two more important institutions in Brazil, PRODESP (Data processing center of the Government of the State of São Paulo) and INPE (national institute for space research).

Prodesp

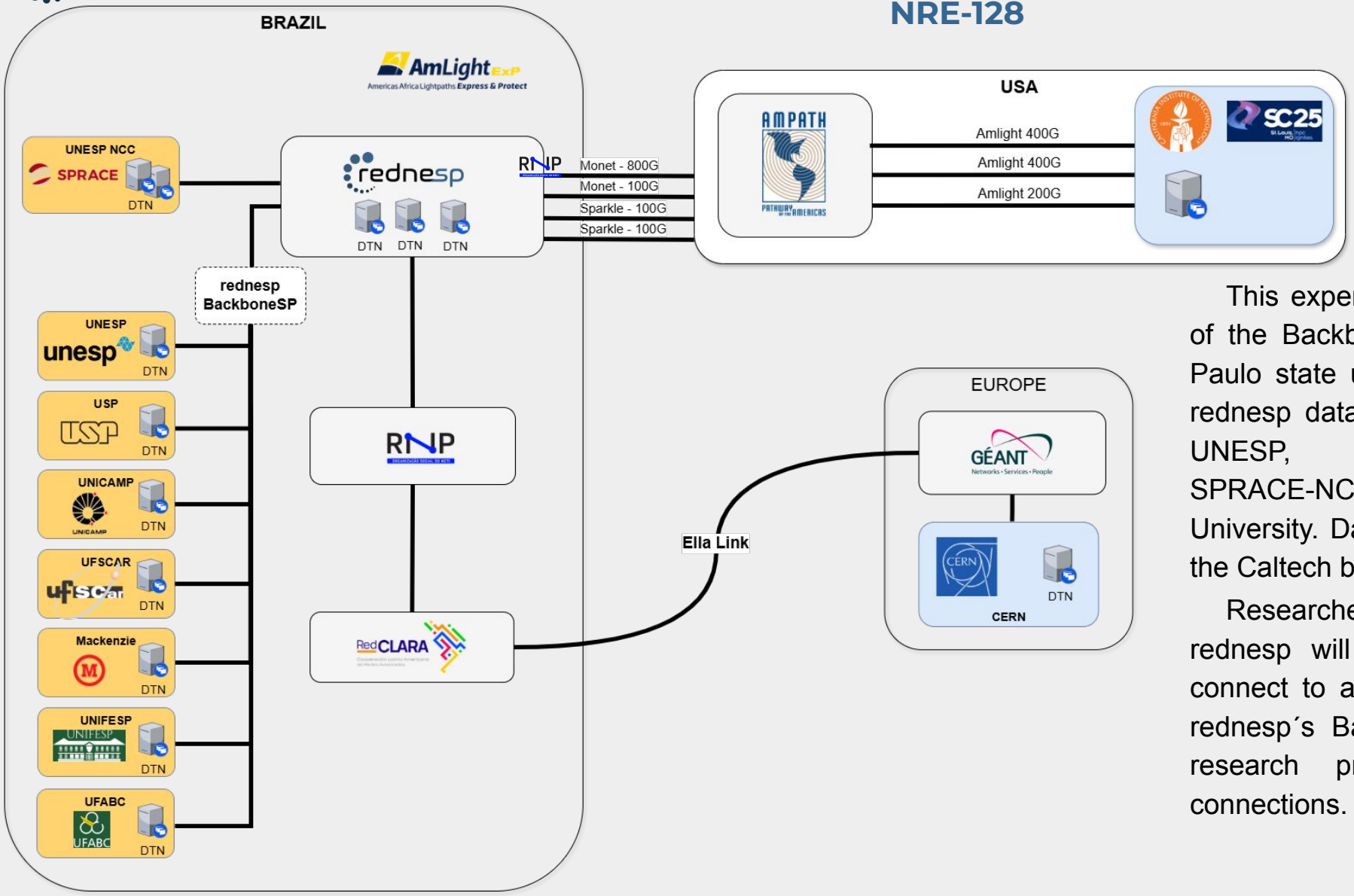
INPE

Rednesp ecosystem



rednesp Research and Education Network of São Paulo

NRE-128



This experiment demonstrates the capabilities of the Backbone SP, interconnecting eight Sao Paulo state universities. DTNs were installed at rednesp datacenter, USP, UFSCAR, UNICAMP, UNESP, UFABC, UNIFESP SPRACE-NCC-UNESP and Mackenzie University. Data will be sent from these DTNs to the Caltech booth during SC25.

Researchers and universities connected to rednesp will be able to use this capacity to connect to all other members of the GNA. The rednesp´s BackboneSP project will allow more research projects to benefit from these connections.

International links from São Paulo to St. Louis

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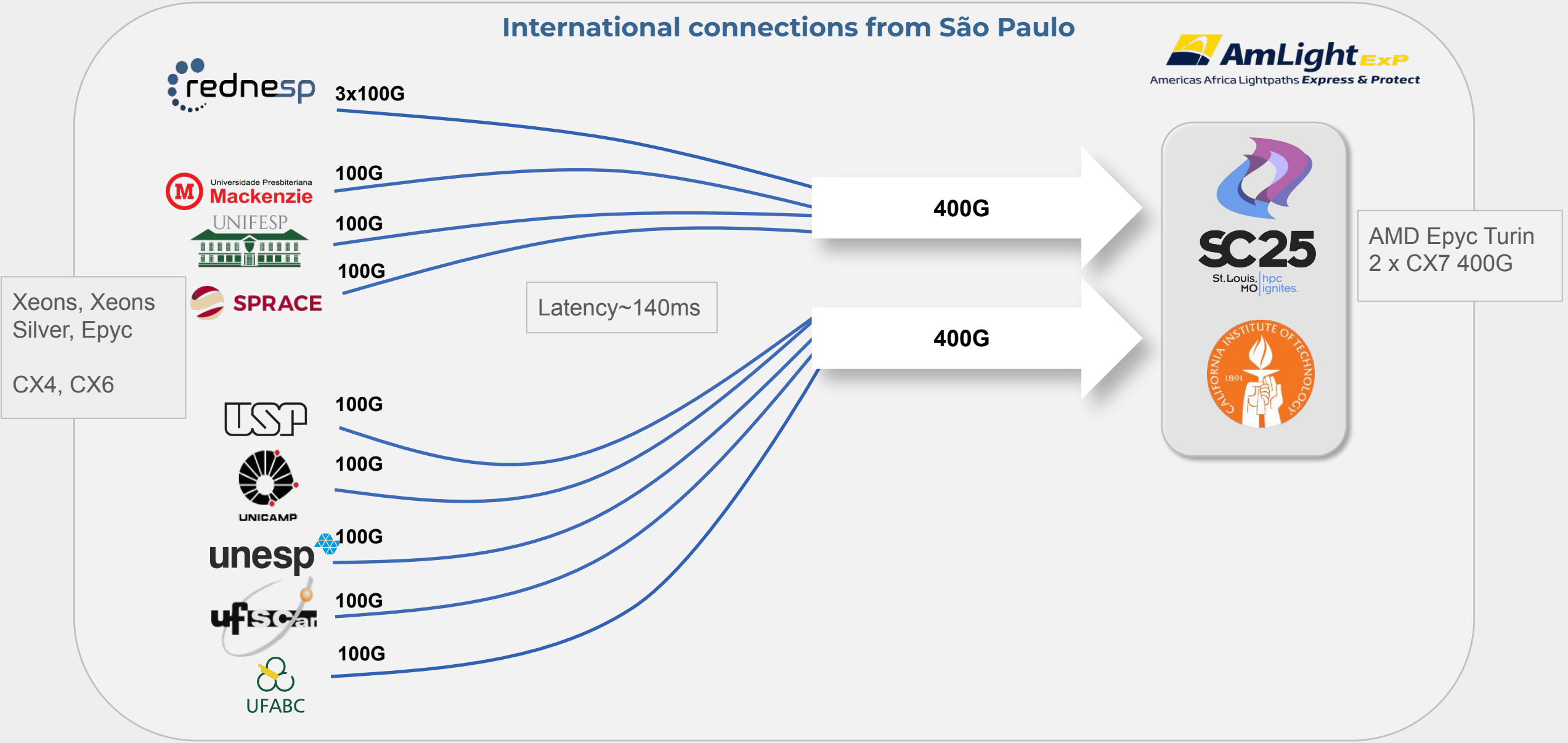
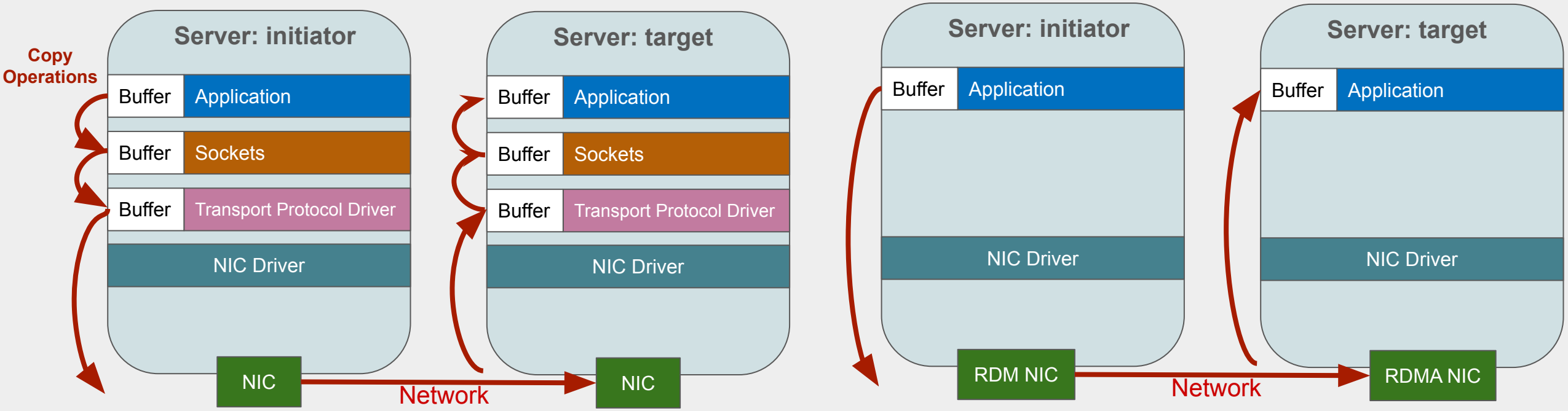
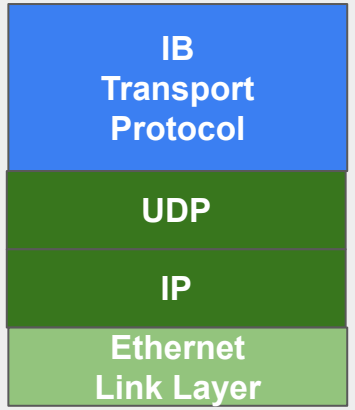
International connections from São Paulo



RDMA



RoCEv2
(RDMA over Converged Ethernet)



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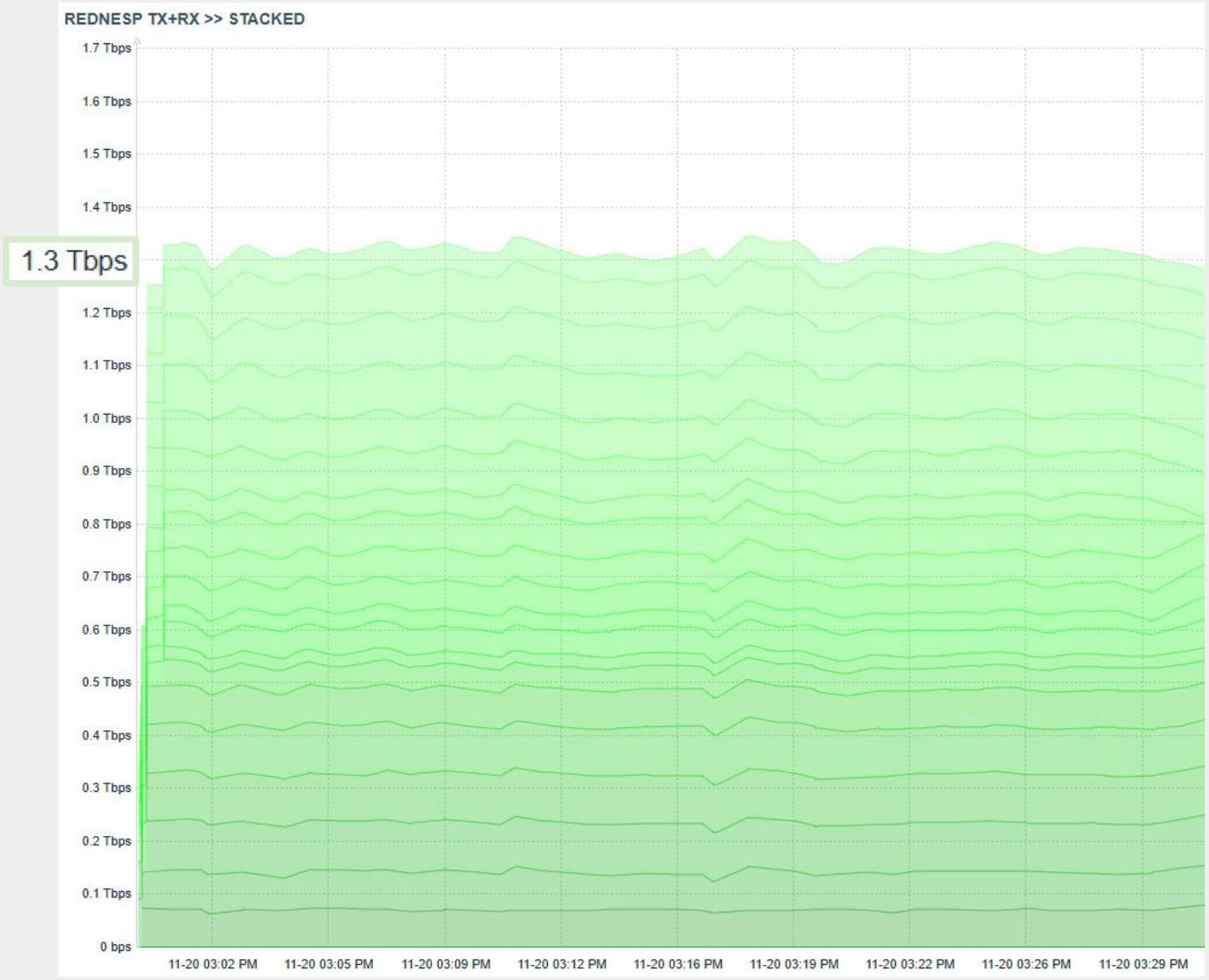
20/nov - perftest



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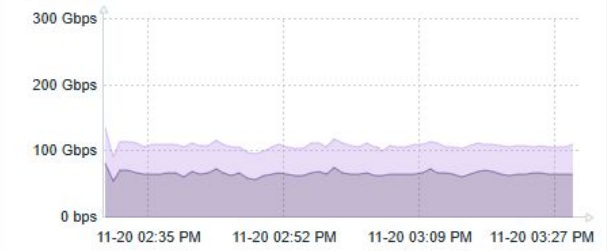
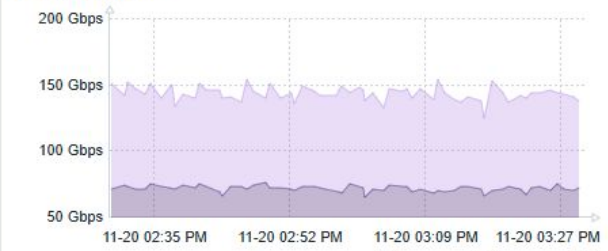
BBSP USP



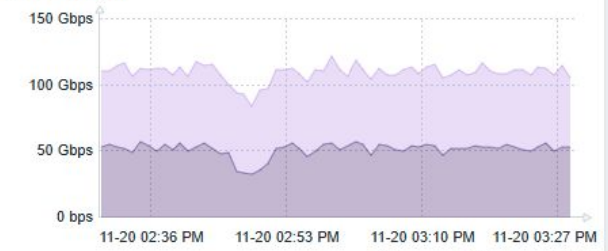
	min	avg	max
BBSP-USP: .SC25-Interface et-0/0/...	56.53 Gbps	67.83 Gbps	83.38 Gbps
BBSP-USP: .SC25-Interface et-0/0/...	37.61 Gbps	42.44 Gbps	53.08 Gbps

BBSP UNICAMP



	min	avg	max
BBSP-Unicamp: .SC25-Interface et-...	65.7 Gbps	72.55 Gbps	76.74 Gbps
BBSP-Unicamp: .SC25-Interface et-...	58.2 Gbps	71.82 Gbps	84.47 Gbps

BBSP Unesp

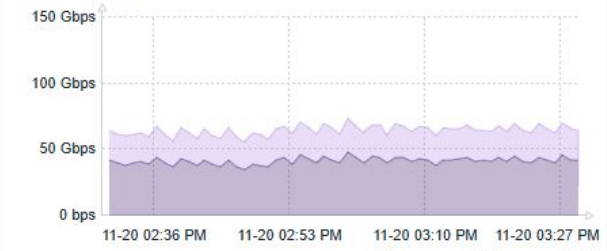


	min	avg	max
BBSP-Unesp: .SC25-Interface et-0/...	33.5 Gbps	52.12 Gbps	57.77 Gbps
BBSP-Unesp: .SC25-Interface et-0/...	50.92 Gbps	58.17 Gbps	66.66 Gbps

BBSP UFABC

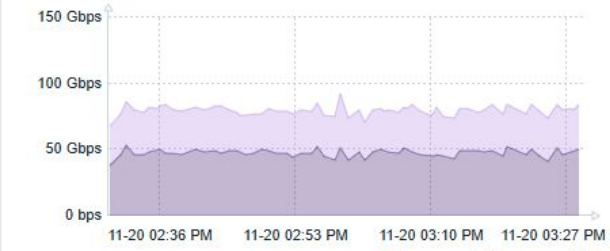
	min	avg	max
BBSP-Ufabc: .SC25-Interface et-0/0/1(DTN_Ufabc_S...	0 bps	0 bps	0 bps
BBSP-Ufabc: .SC25-Interface et-0/0/1(DTN_Ufabc_S...	0 bps	0 bps	0 bps

BBSP Mackenzie



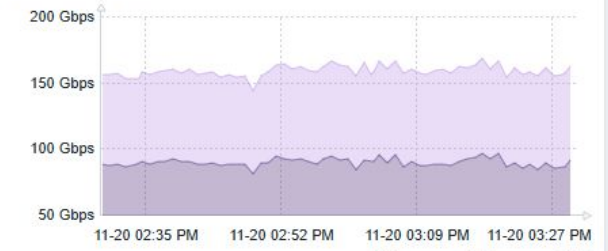
	min	avg	max
BBSP-Mackenzie: .SC25-Interface ...	35.77 Gbps	42.06 Gbps	48.57 Gbps
BBSP-Mackenzie: .SC25-Interface ...	19.73 Gbps	23.02 Gbps	25.59 Gbps

BBSP UFSCAR



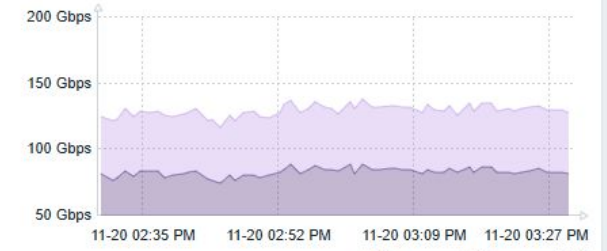
	min	avg	max
BBSP-Ufscar: .SC25-Interface et-0/...	38.18 Gbps	48.03 Gbps	53.46 Gbps
BBSP-Ufscar: .SC25-Interface et-0/...	27.01 Gbps	32.13 Gbps	41.2 Gbps

BBSP UNIFESP



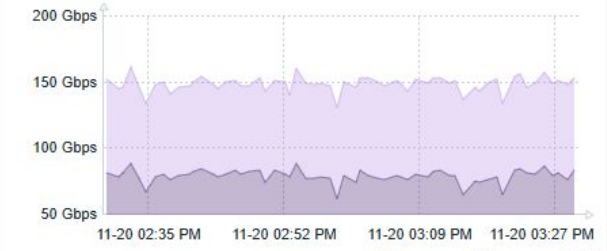
	min	avg	max
BBSP-Unifesp: .SC25-Interface et-...	82.85 Gbps	90.81 Gbps	97.5 Gbps
BBSP-Unifesp: .SC25-Interface et-...	62.63 Gbps	69.32 Gbps	73.81 Gbps

UNESP NCC



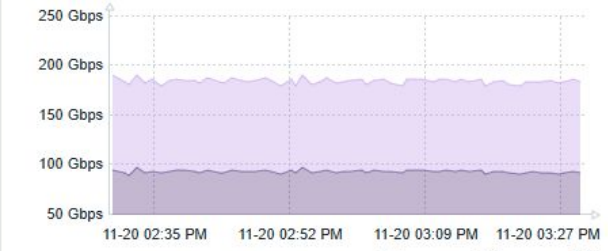
	min	avg	max
SPO-rednesp-02: .SC25-Interface ...	74.95 Gbps	83.52 Gbps	89.4 Gbps
SPO-rednesp-02: .SC25-Interface ...	42.44 Gbps	46.54 Gbps	49.87 Gbps

REDNESP SP4 - DATOLITA



	min	avg	max
SPO-rednesp-02: .SC25-Interface ...	63.05 Gbps	79.97 Gbps	89.91 Gbps
SPO-rednesp-02: .SC25-Interface ...	61.38 Gbps	69.59 Gbps	74.27 Gbps

REDNESP SP4 - TURQUESA



	min	avg	max
SPO-rednesp-02: .SC25-Interface ...	90.7 Gbps	94.36 Gbps	98.69 Gbps
SPO-rednesp-02: .SC25-Interface ...	86.76 Gbps	91.24 Gbps	95.07 Gbps

REDNESP SP4 - AMETISTA

	min	avg	max
SPO-rednesp-02: .SC25-Interface ...	69.41 Gbps	89.65 Gbps	96.77 Gbps
SPO-rednesp-02: .SC25-Interface ...	79.76 Gbps	89.69 Gbps	95.97 Gbps

University of Sao Paulo (USP) High Performance Dark Fiber Infrastructure

SC25 NETWORK RESEARCH EXHIBITION: NRE129

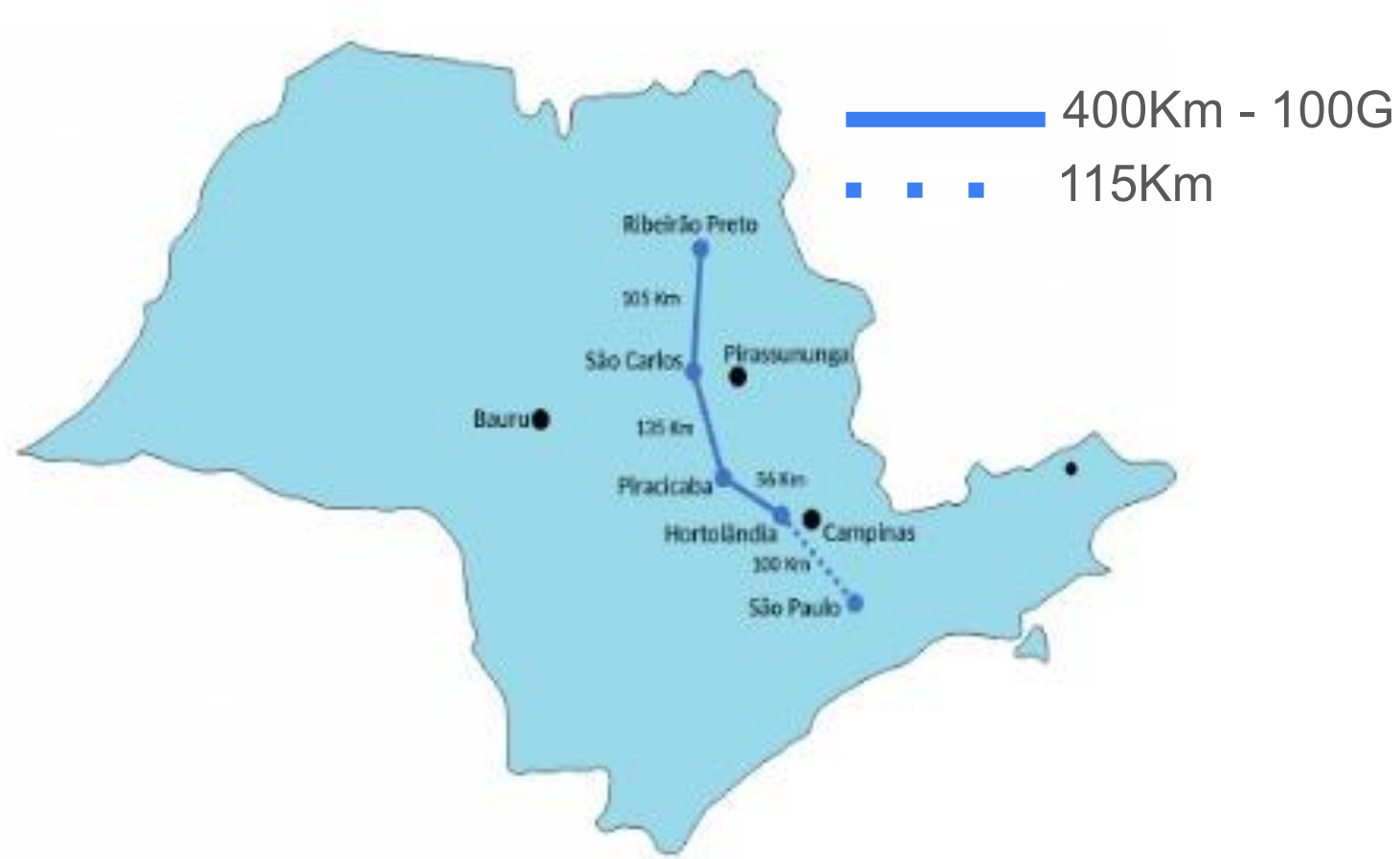
PRESENTERS/AUTHORS: CARLOS A RUGGIERO (REDNESP/USP), HARVEY NEWMAN (CALTECH/GNA), JOAO EDUARDO FERREIRA (REDNESP/USP), JORGE M ALMEIDA (USP), BRUNO BALDIM, ROGERIO MOTITSUKI AND COLLEAGUES

Introduction to USP

- A major public university in Brazil, maintained by the State of São Paulo.
- Consistently ranked as one of the top 100 universities globally and the best in Latin America.
- Features 10 campuses, with the main four (São Paulo, São Carlos, Ribeirao Preto, Piracicaba) responsible for most internet traffic.

The Dark Fiber Infrastructure

- **Initiative:** In 2016, USP began interconnecting its four main campuses via a dark fiber infrastructure
- **Enablement:** Made possible by a state law allowing use of state highway land for deploying ducts and fibers.
- **Specifications:**
  - All inter-campus connections use fiber optic cables.
  - Each cable contains 36 pairs of fibers.
  - Cables are routed through ducts buried over one meter deep.


400Km - 100G
115Km
Ribeirão Preto
São Carlos
Pirassununga
Bauru
Piracicaba
Hortolândia
Campinas
São Paulo

Current Status & Capacity

- **Inter-campus Bandwidth:** Currently 100 Gbps.
- **External Connectivity:**
  - The main Sao Paulo campus connects to Rednesp at 100 Gbps.
  - Rednesp has an existing 400 Gbps connection to the United States.
- **Potential:** This robust infrastructure facilitates a wide range of experiments in high-performance networking and fiber optic data communication.

Future Projections & Goals

- Bandwidth Growth:
  - Inter-campus bandwidth projected to reach 1 Tbps in 2026
  - São Paulo campus connection to Rednesp to be upgraded to 400gbps
  - Rednesp's US connection set to expand to 1 Tbps by the end of 2026.
- Strategic Goals:
  - To showcase the R&D potential of its dark fiber infrastructure.
  - Deploy advanced services developed by SENSE, NRP, and GP4L.
  - Engage with global working groups (GNA-G, AutoGOLE/SENSE, NRP) to become a leading partner in data-intensive sciences.

Involved Parties

- **USP**
  - Teams from various campuses: João Eduardo Ferreira, Jorge Marcos de Almeida, Carlos Antonio Ruggiero and many others.
- **Caltech HEP**
  - Harvey Newman.
- **Rednesp**
  - The Rednesp team: Rogerio Motitsuki, Bruno Baldim, Ney Lenke, Ricardo Dahab, Daniel M Batista

rednesp Research and Education Network of São Paulo

Thank you

Caltech
Prof. Dr. Harvey Newman

rednesp - executive board CRUESP-FAPESP
Prof. Dr. Ney Lemke (UNESP) - coordinator
Prof. Dr. Daniel Macedo Batista (USP)
Prof. Ricardo Dahab (UNICAMP)

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Geraldo Teodoro
Paulo Sérgio Simionato
Rogerio Shiguematsu Motitsuki

USP
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UNESP-Sprace
Rogério Iope
Marcio Antonio Costa
Valdinei Rodrigues dos Reis

Mackenzie
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Pedro Clarindo Junior

UFABC
Ricardo Mussini
Felipe Baena Garcia

UNIFESP
Marcelo Augusto Moraes Leonardeli

Amlight
Jeronimo Bezerra
Italo Valcy Silva Brito
Renata Frez de Lima

RNP
Marcos Schwarz

RedClara
Marco Teixeira
Tiago Monsores

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Fábio Rogério da Silva
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