

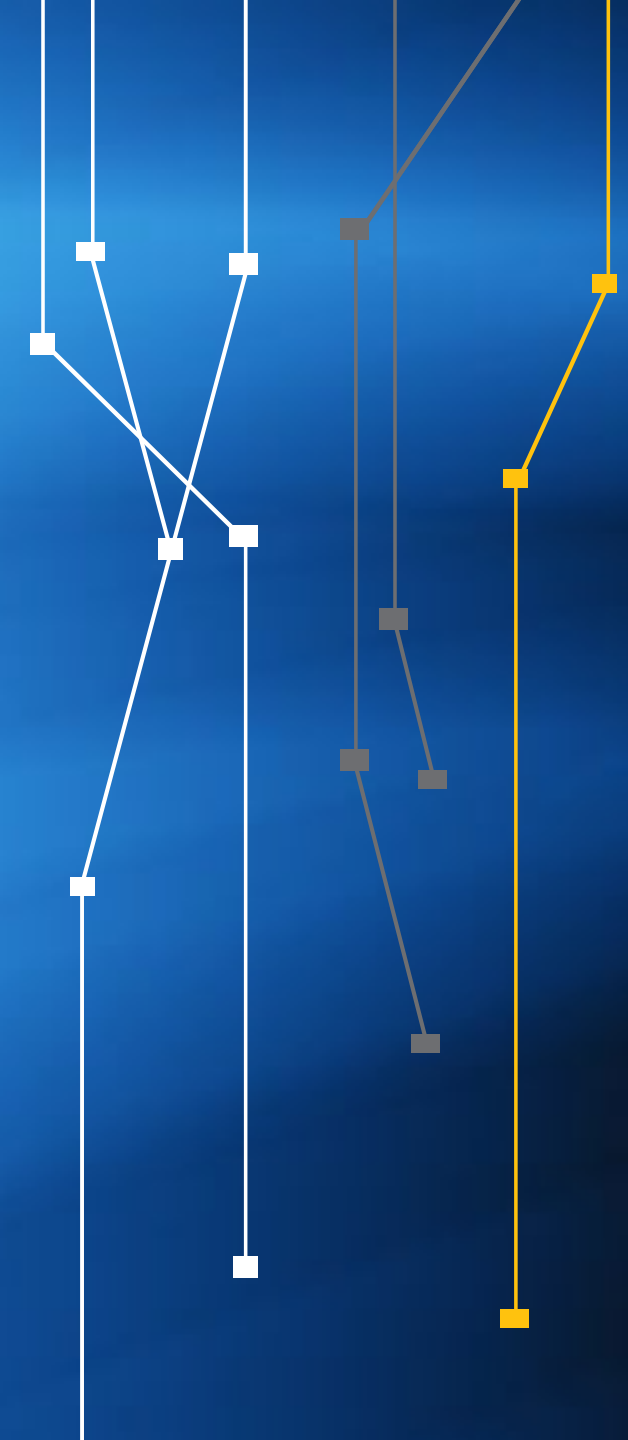
# Building NextGeneration International Networks

ON\*VECTOR Workshop, UCSD

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RNP, Brazil



Ministério da  
**Cultura**

Ministério da  
**Saúde**

Ministério da  
**Educação**

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**Ciência, Tecnologia  
e Inovação**



# Objective: present ongoing developments in South America for improved connectivity

- **Motivation: imbalance in current situation**

RNP's International links:

- **To US**, shares with ANSP (state network in São Paulo) infrastructure of successive IRNC projects: currently Amlight Exp (**240G currently available capacity**)
- **To Europe (5G)** and Latin America (**10G**) via RedClara
- **Terrestrial link** between Porto Alegre and Buenos Aires (Argentina), used also by RedClara and InnovaRed (AR)

**Effectively, South America is a backwater, connected to the rest of the world via North America**

## To reinforce the point – GLIF map 2011

Unfortunately, the edition currently in preparation will show a topologically similar situation for South America

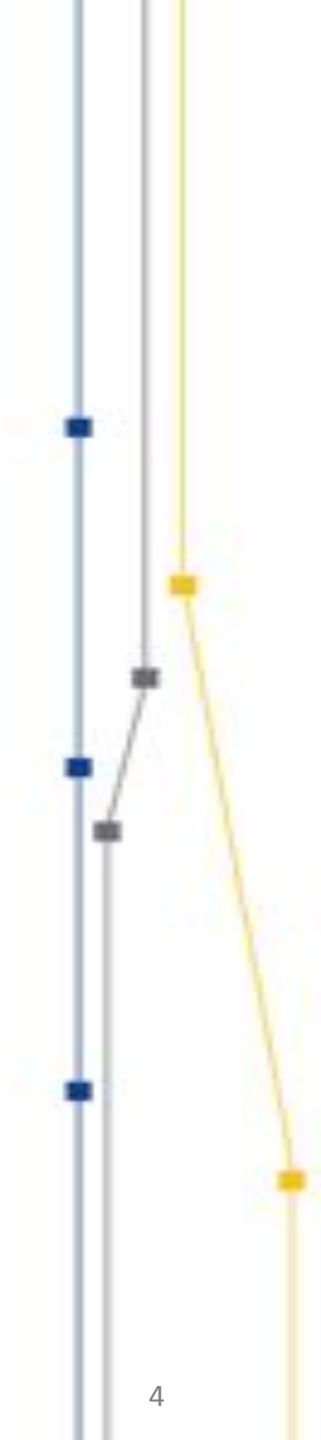


# Nowadays, international connectivity relies essentially on submarine cable infrastructure

To reach South America, between 2000 and 2013, the only cables available were 5 new cables in service in 2000:

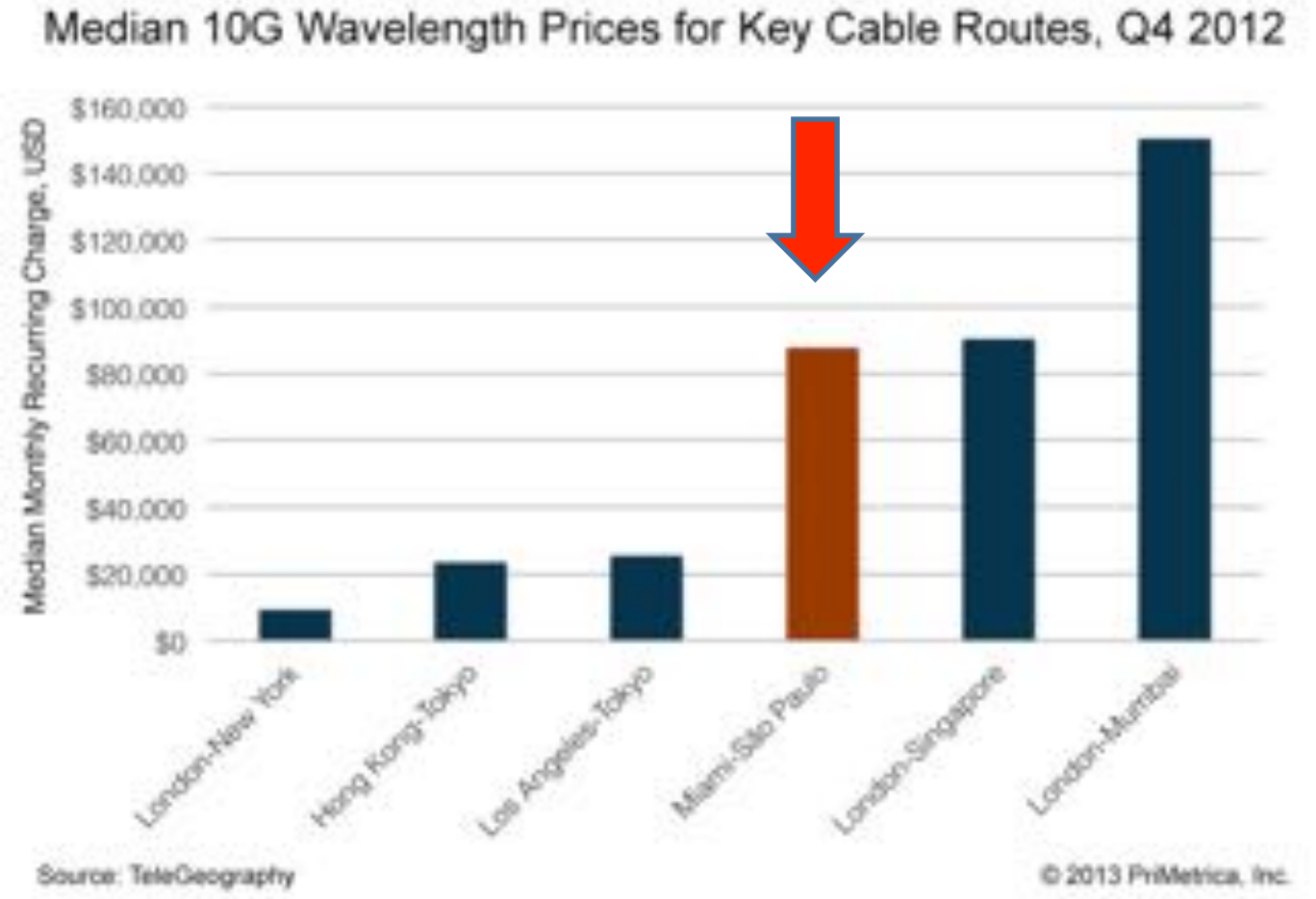
- **Pre-Internet cables (only voice traffic)**
  - Americas 2 (US)
  - Atlantis 2 (EU)
- **1<sup>st</sup> generation Internet (10G)**
  - GlobeNet, SAC/LAN, SAm-1 (US)

This effectively produced the situation of South American connectivity depending entirely on North America, specifically on Florida.



# Relative costs of reaching South America

- The lack of effective alternatives has also made connectivity to South America very expensive
- In 2012, the median cost of a 10G wave Miami-S.Paulo was about 10x the cost of London-New York

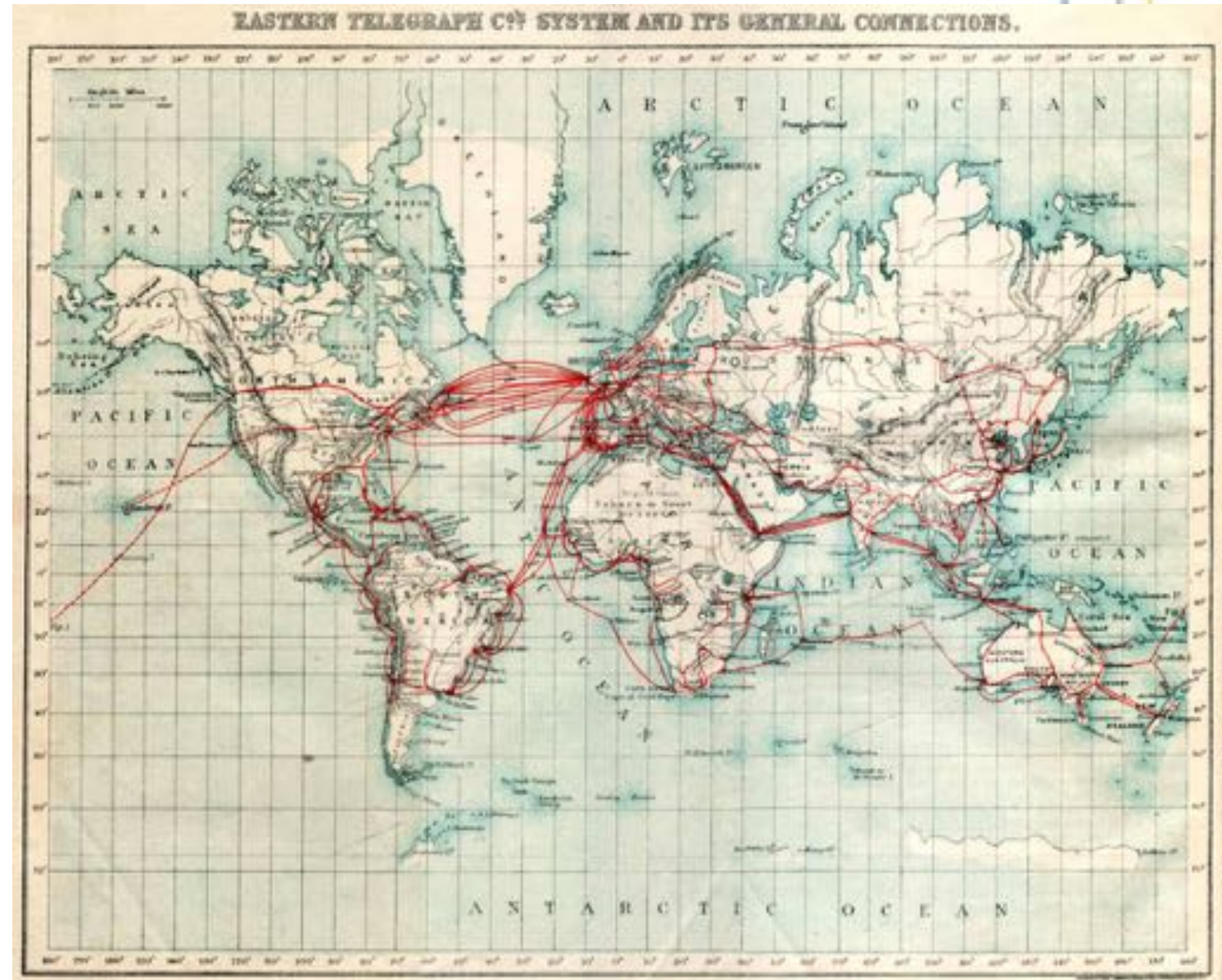


# It was not always this way – submarine telegraph cables of the “Victorian Internet”

The international boom in telegraphy after 1850 led to the construction of an immense mesh of submarine cables bringing almost instantaneous global communications.

In the specific case of Brazil, 3 cables from Europe were laid, starting in 1874.

South-South connectivity was also available: e.g. Brazil-Angola



# Good times are coming back: New 100G cables to Brazil (built, under construction or planned)

- New undersea cables to Brazil by 2018 from:

- USA (3)
  - BRUSA
  - Monet
  - Seabras-1
- Europe (1)
  - EllaLink
- Africa (2)
  - CBCS, now SAIL
  - SACS
- S. America (1)
  - Tannat

Only Seabras-1 will  
not land in Fortaleza



## Ellalink cable (by 2019)

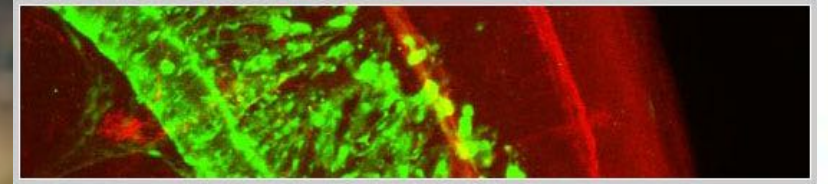
- Owners: Eulalink (joint venture Brazil-Spain)
- Service date: 2019
- Major landing points: Sines (Portugal), Fortaleza and Praia Grande (Brazil)
- Capacity: 4 fibre pairs, 37.5 GHz grid





# European interest in Latin America – Growing Collaboration

- Growing collaboration:
  - Basic sciences (CRIA, Max Planck, etc.)
  - Applied sciences (CGIAR)
  - Social Sciences
  - Industrial R&D
  - Open Access
- European facilities of interest to Latin American R&E community:
  - Structure of matter (CERN, ...)
  - Plasma energy generation (ITER, ...)
  - Molecular Biology (EMBL, ...)
  - Instrumentation (NOVA, ...)
  - Application-oriented R&D (Fraunhofer Gesellschaft, ...)



# Research Facilities in Latin America



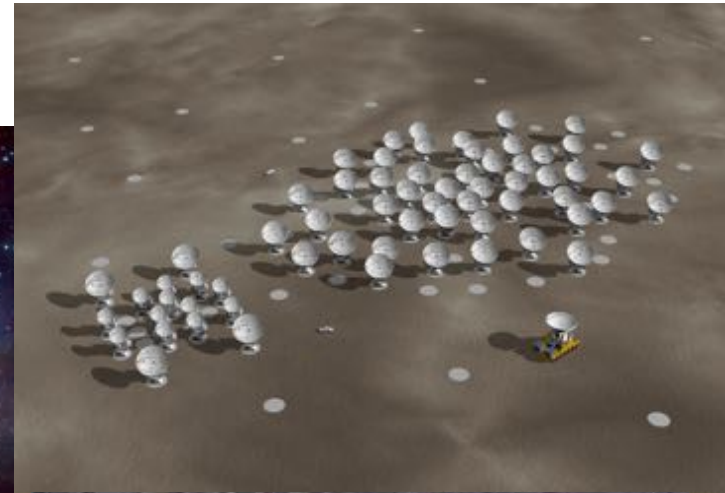
Cerro Paranal



E-ELT



ALMA



Pierre Auger Observatory

(From Tom Fryer's TNC16 presentation)



# BELLA - Building Europe Link to Latin America

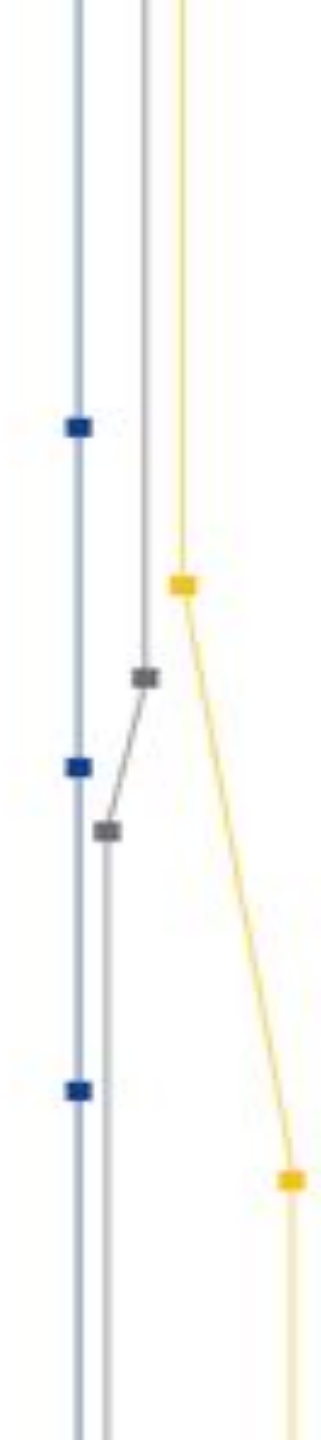
- A joint project between partners from Europe and Latin America to build a closer relationship between their regional R&E networks: GÉANT and RedCLARA.
- History: Starting in 2003 the EC financed the projects ALICE and ALICE2 to help build and extend the RedCLARA network

RedCLARA network in 2016



# BELLA Objectives

- Obtain IRU of 40 optical channels on a direct submarine cable between Brazil and Portugal.
- Deploy two upgradeable 100Gbps links for:
  - GÉANT-RedCLARA interconnection
  - Copernicus traffic
- Complete RedCLARA dark fibre network and deploy a 100Gbps upgradeable network from Brazil to Colombia
- Improve Europe-Latin America research collaboration by ensuring long-term sustainability of high-capacity GÉANT-RedCLARA interconnection



# BELLA Topology: The Complete Picture

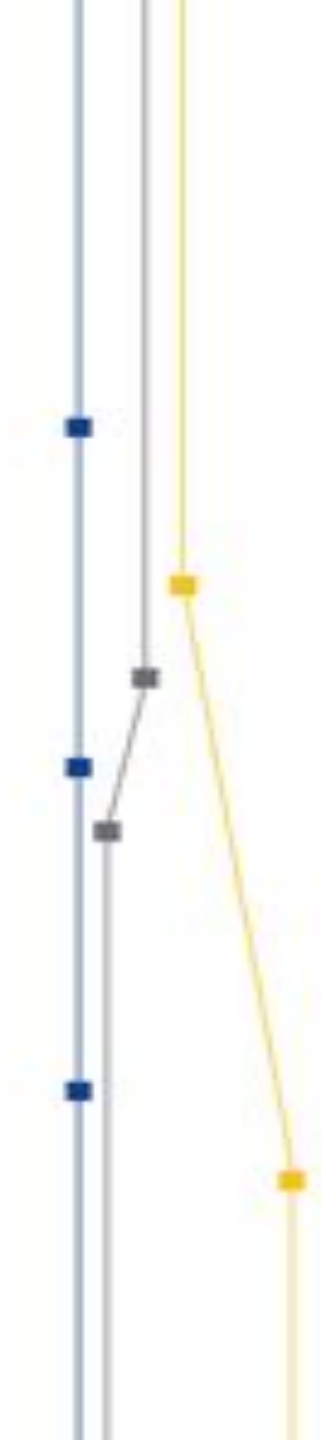
Divided into 2 parts:

- BELLA-S: submarine cable section
- BELLA-T: terrestrial section (includes possible submarine link Colombia-Brazil)
- Seeks to explore synergies between RedCLARA and national networks by sharing optical infrastructure



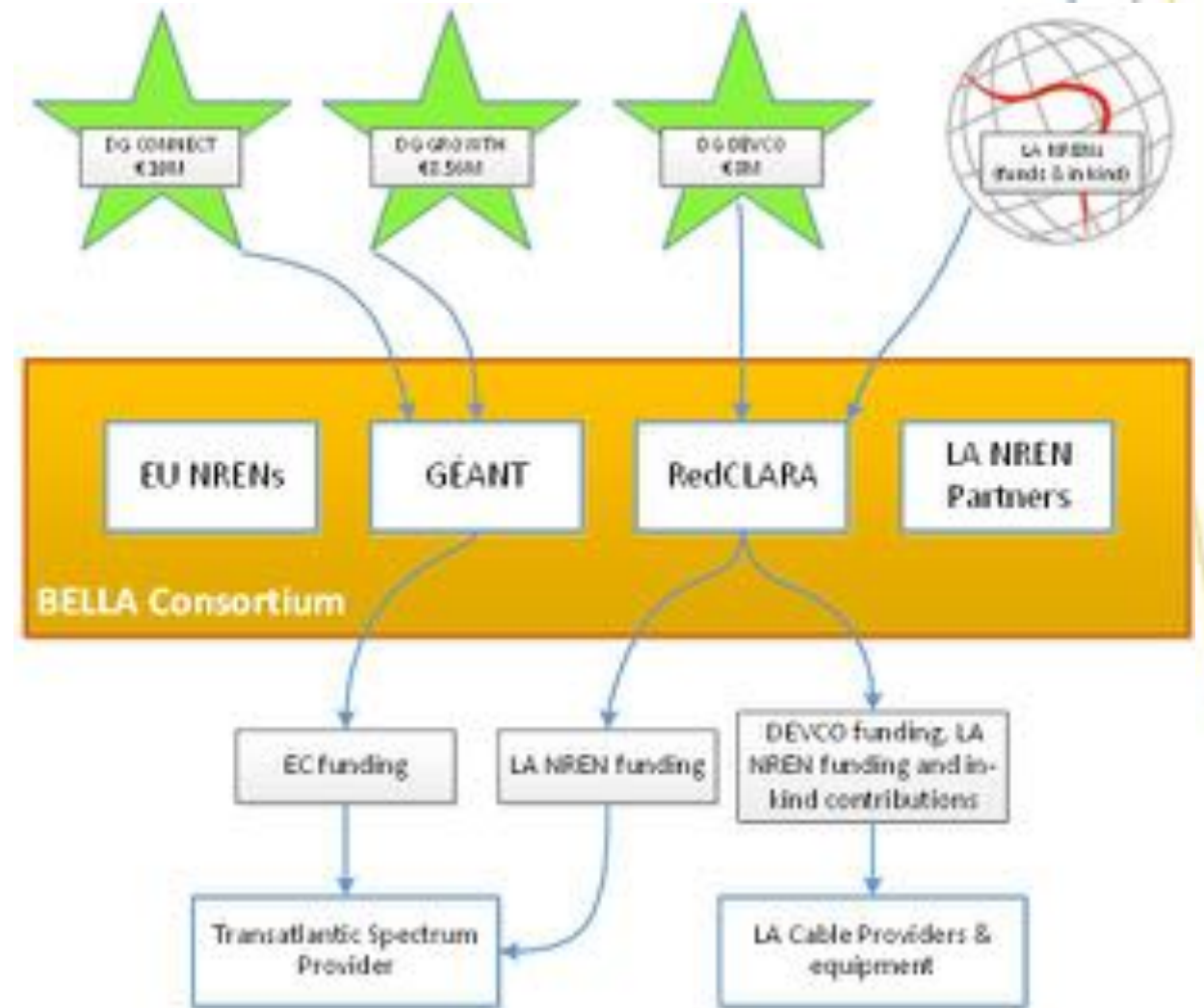
# Building BELLA: the BELLA Consortium

- Purpose:
  - To coordinate among partners and projects to ensure overall success of BELLA implementation work
  - To coordinate responsibilities for BELLA Operations (specifically transatlantic) and incremental costs
- Participants:
  - Europe: GÉANT, DFN (Germany), FCT|FCCN (Portugal), GARR (Italy), RedIRIS (Spain), RENATER (France)
  - Latin America: RedCLARA, CEDIA (Ecuador), RENATA (Colombia), REUNA (Chile), RNP (Brazil)
- Duration:
  - Lifetime of IRU



# Funding BELLA

- EC is providing over 18.5M€ to GÉANT and 8M€ to RedCLARA
- LA-NRENs are making cash and in-kind contributions to both the BELLA-S and BELLA-T parts.
- In-kind contributions based on provision of expandible optical infrastructure



# BELLA-S: Procuring Transatlantic Spectrum

- Transatlantic spectrum procurement published June/2016 called for:
  - IRU for 40% of spectrum on one fibre pair of a direct submarine cable
  - IRU to last for lifetime of the cable, minimum of 25 years
  - O&M costs for duration of IRU to be included in price
  - To implement two initial 100Gbps waves: one for use by GÉANT-RedCLARA; one for use by Copernicus.
  - Backhaul in Europe of initial waves from landing station to Lisbon or Madrid
  - Backhaul of additional waves in Europe at cost price
  - Cards for additional lambdas to be paid by GÉANT, RedCLARA, and/or NRENs as appropriate.
- 4 responses received. Currently negotiating only with Eulalink for spectrum between Sines and Fortaleza



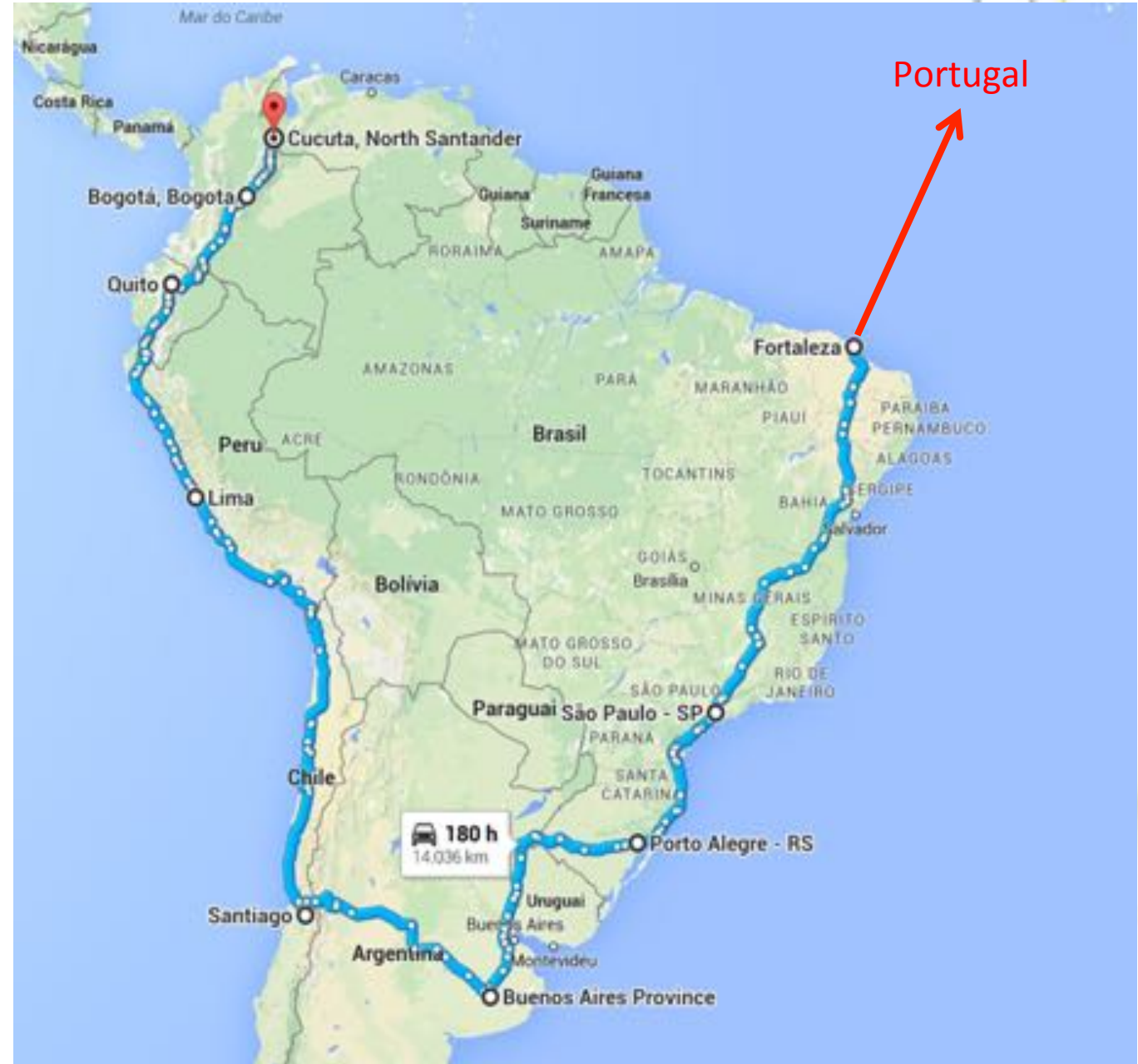


# BELLA-T

- Fibre infrastructure and optical transport support ("in-kind") is being made available by NRENs of Brazil, Chile (in part), Colombia and Ecuador
- A tender, just published by RedCLARA, is calling for IRUs of fibre or spectrum on sections of the proposed network, particularly in Argentina, Brazil, Chile and Peru, and for the submarine section between Colombia and Brazil

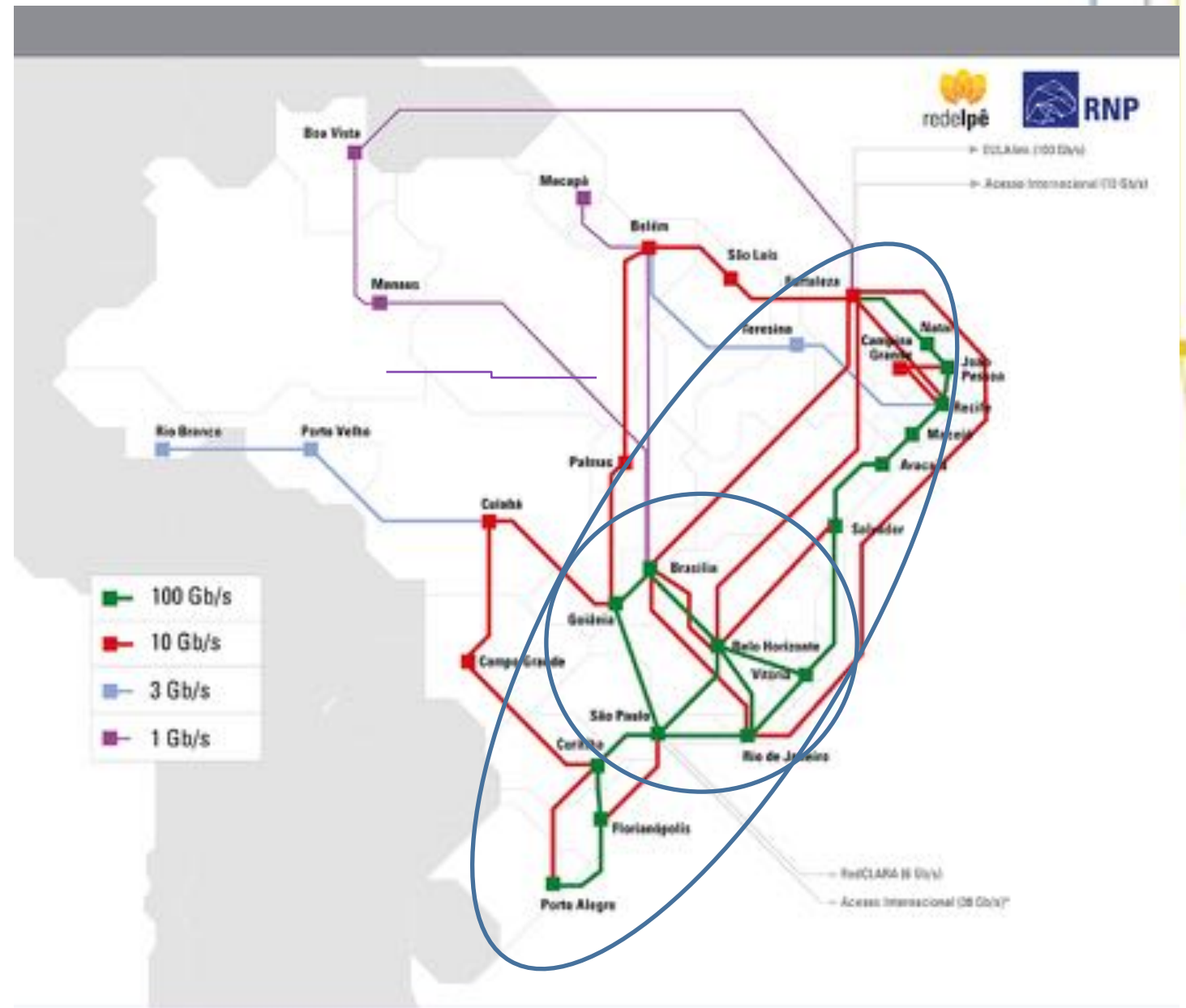
# BELLA-T and RNP

- The Ellalink cable will be used for the transatlantic section, requiring RNP to provide backhaul for the section between Fortaleza and Porto Alegre in the south.
- RNP is currently seeking for owners of appropriately located FO infrastructure prepared to share this with RNP to be used by both BELLA-T and RNP.



# RNP National Backbone 2018

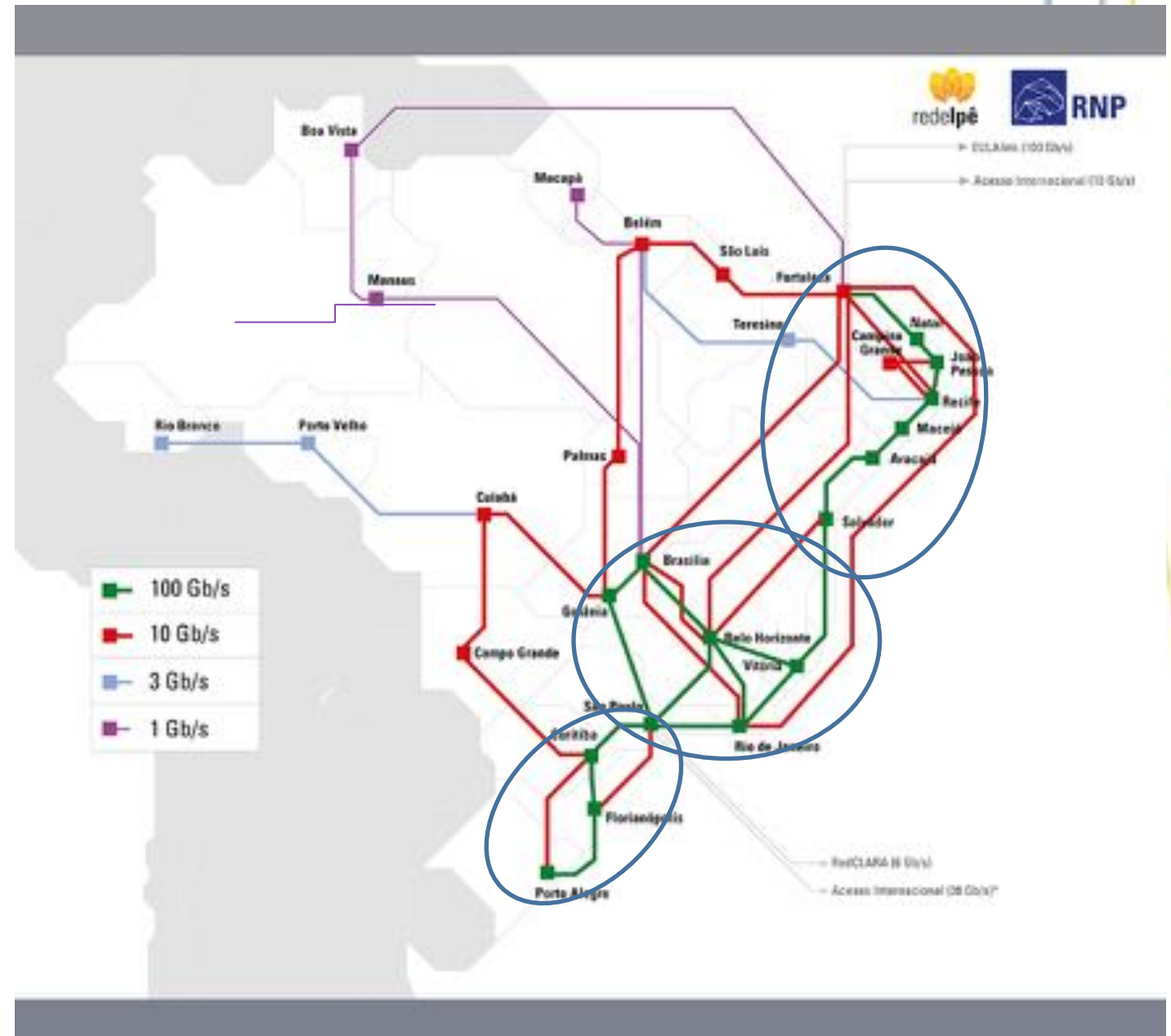
- Fortaleza – Porto Alegre Route
- 100 G Southeast Ring



(From Eduardo Grizendi, RNP)

# RNP National Backbone 2018

- **3 phases:**
  - Northeast region (NE)
  - Southeast region (SE)
  - Southern region (S)



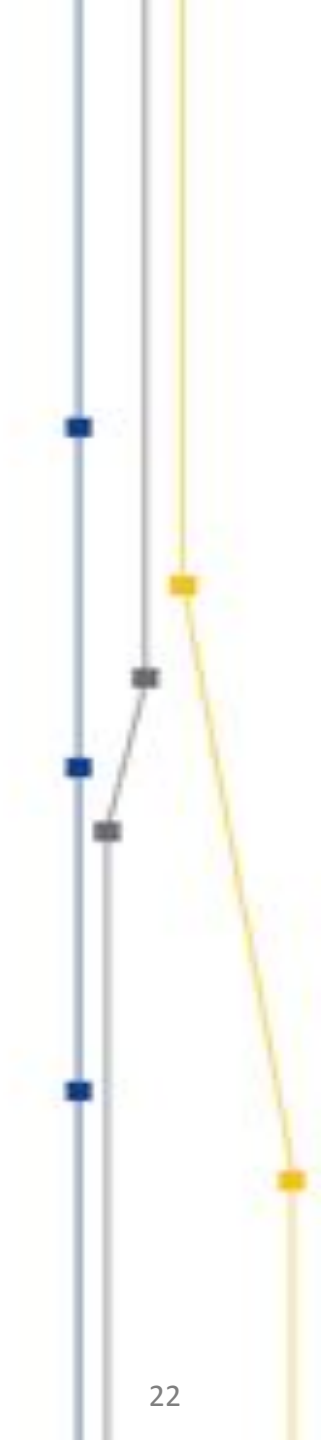
# Northeast – Alliance with CHESF

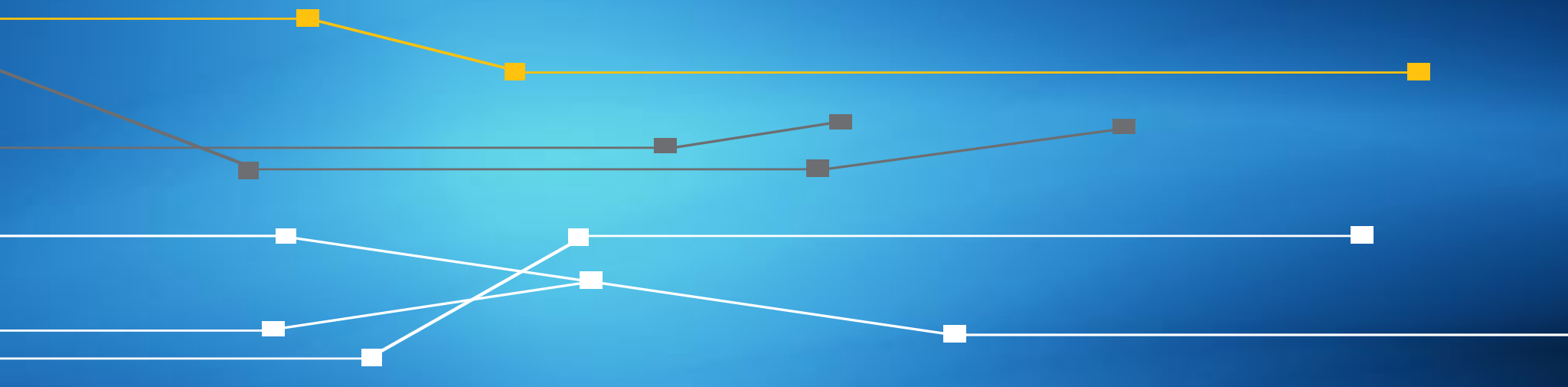
- CHESF – Companhia Hidro Elétrica do São Francisco (part of the federal gov't energy company, Eletrobrás)
- Right of Use of ½ the optical spectrum
- Optical transport to be acquired by RNP
- Initially using 3 × 100G waves
- Part of the Fortaleza - Porto Alegre route
  - Fortaleza - Recife – Salvador – South of Bahia
- Agreement signed on Sept 19, 2016



## RNP expectations

- In 2017: to make agreements similar to that with CHESF with other large fibre-owners in the Southeast and South regions.
- This will enable by 2018 to upgrade to 100G the major part of the national backbone between Fortaleza and Porto Alegre, as well as the Southeast ring, connecting São Paulo and Rio de Janeiro with Brasília and Belo Horizonte.





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