

SouthernLight: New GOLE for Latin America

8th Annual Global LambdaGrid Workshop
Seattle, October 2008

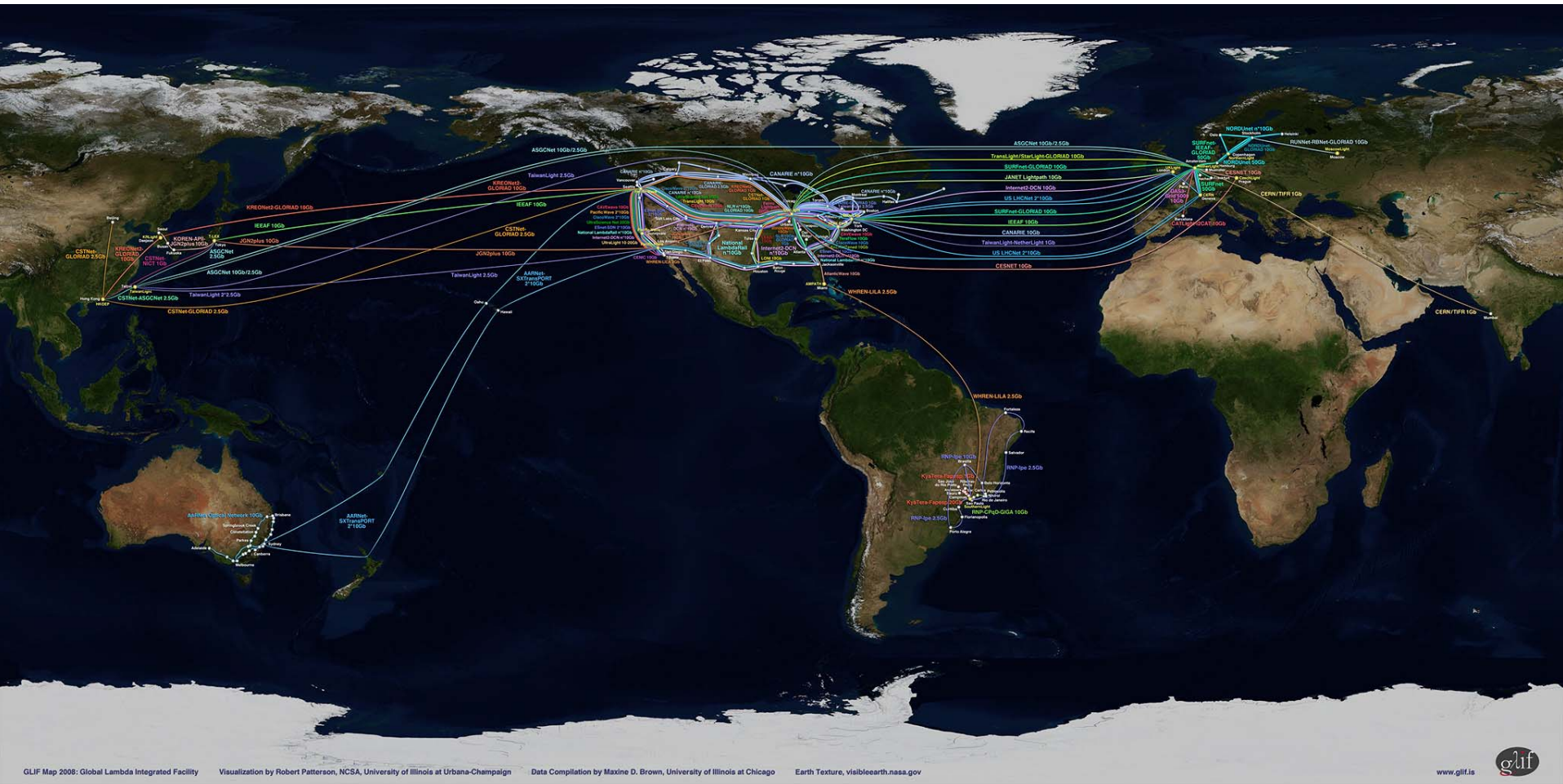
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Introduction



- The WHREN-LILA (IRNC) link was installed between Miami and São Paulo in 2005, and appeared on the 2005 GLIF map as a “bridge to nowhere”.
- The production of the new map this year stimulated the formalisation of Brazilian participation in the GLIF community, putting our resources on the map:
 - 3 networks
 - Southern Light GOLE in São Paulo
 - (for now) two GLIF members (CPqD and RNP)

Global Lambda Integrated Facility World Map (2008)



GLIF Map 2008: Global Lambda Integrated Facility Visualization by Robert Patterson, NCSA, University of Illinois at Urbana-Champaign Data Compilation by Maxine D. Brown, University of Illinois at Chicago Earth Texture, visableearth.nasa.gov

www.glif.is

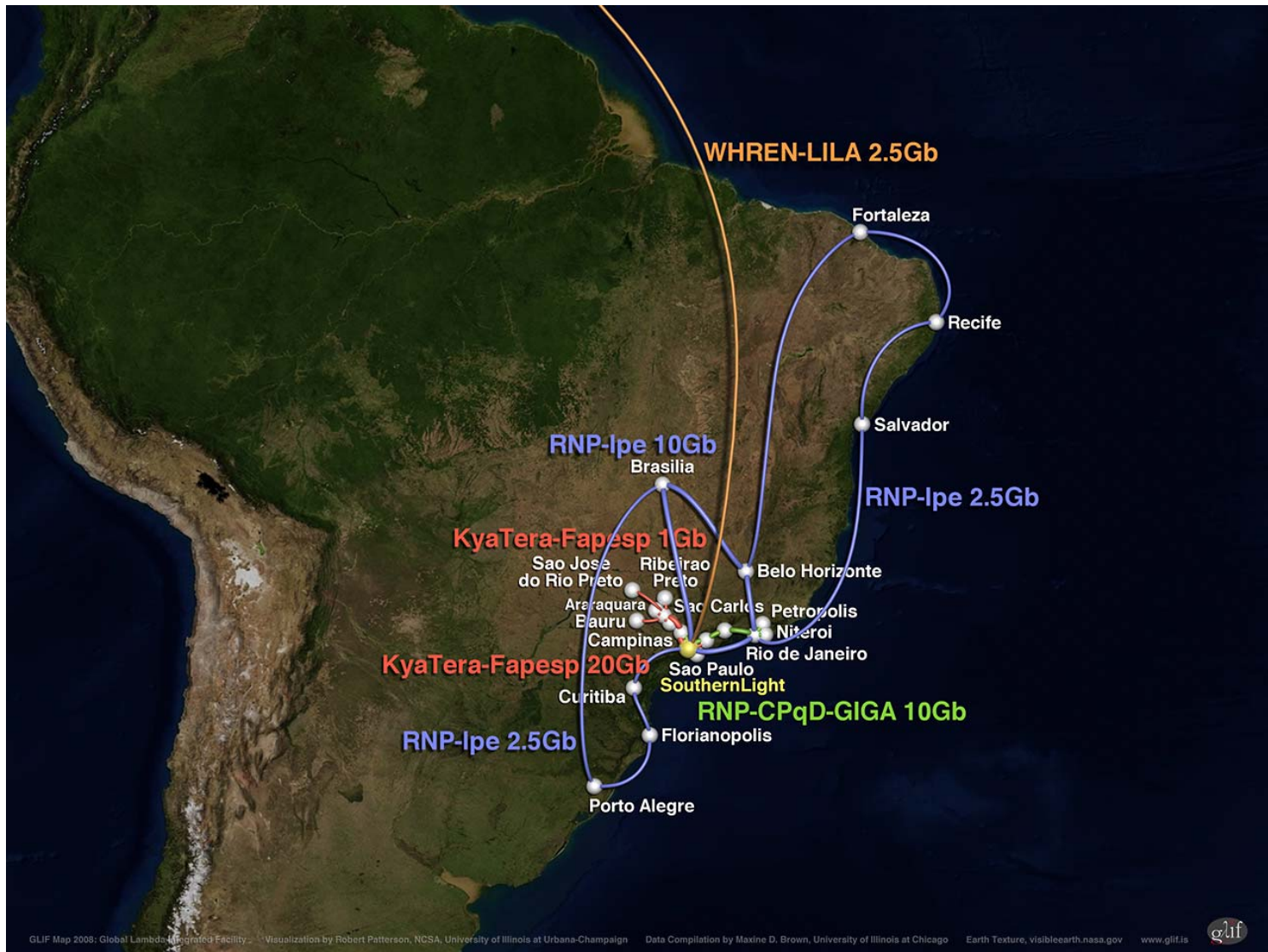
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Southern Light: GOLE in Latin America

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GLIF - Brazil (2008)



GLIF in Brazil



- Brazil's contribution to GLIF comes from 3 separate networks:
 - RNP's national R&E network
 - leases 2.5 and 10G waves to 10 cities from local telcos (12000 km)
 - building dark fibre metro networks in 27 state capitals
 - Project GIGA optical testbed, run by RNP and CPqD (former telco industry R&D centre)
 - dark fibre linking 20 research institutions in 7 cities (750 km)
 - KyaTera research network in São Paulo state
 - dark fibre linking research institutions in 9 cities (1000 km)
- Southern Light GOLE in São Paulo connected to AMPATH GOLE in Miami by the WHREN-LILA link (IRNC)
 - currently 2.5 Gbps
 - will increase to at least 10 Gbps this year (10G unprotected link currently costs \$2.5M annually)

IPÊ – RNP's national backbone network

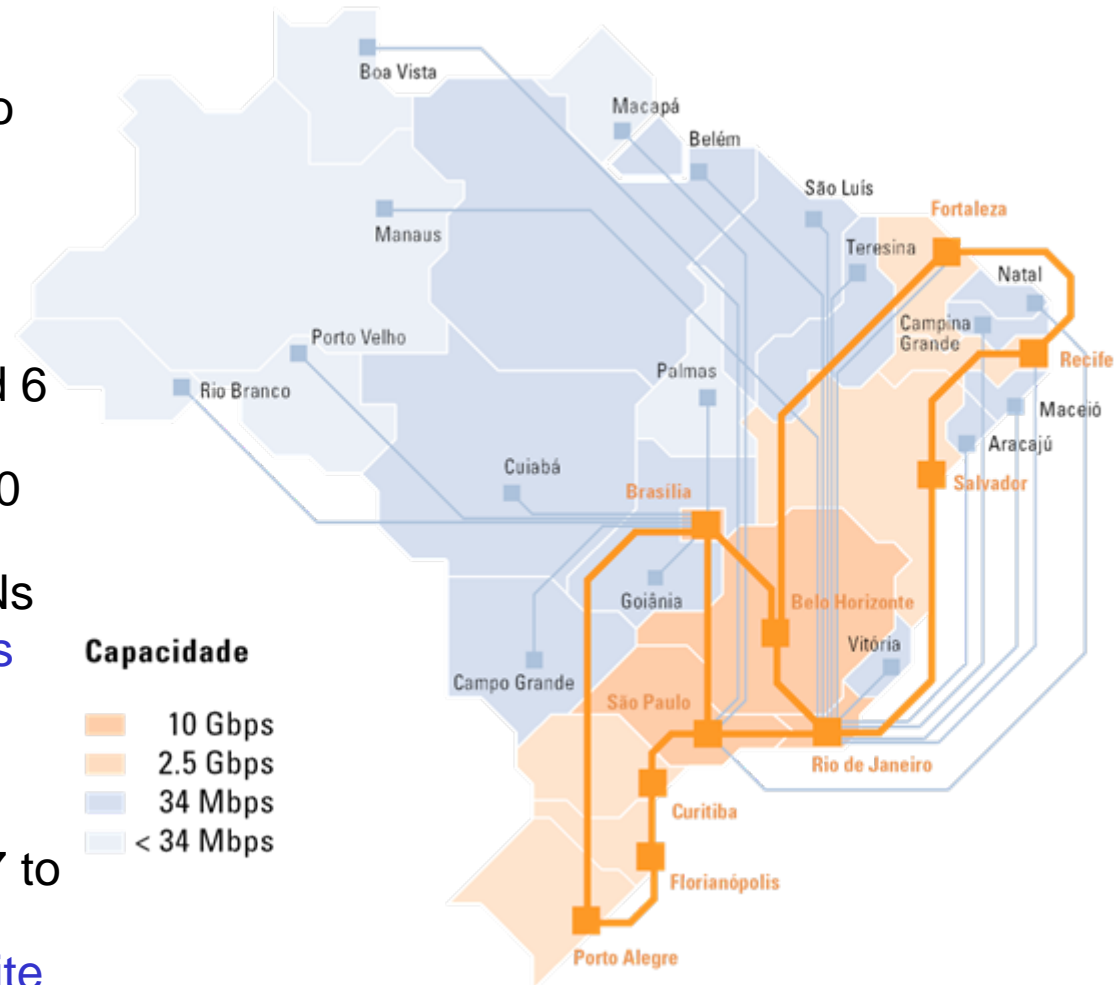


Last major reform in 2005

Capacity reflects available telco infrastructure

Currently composed of:

- **Multigigabit core network**
 - 4 PoPs at 10 Gbps, and 6 PoPs at 2.5 Gbps
 - IP over lambdas (12.000 km)
 - MPLS used with L2VPNs
- **Terrestrial SDH connections to 15 PoPs**
 - Most links are 34 Mbps
 - Some at 2 Mbps
 - Some upgrades in 2007 to 102 and 155 Mbps
- **2 PoPs connected by satellite at 2 and 4 Mbps**



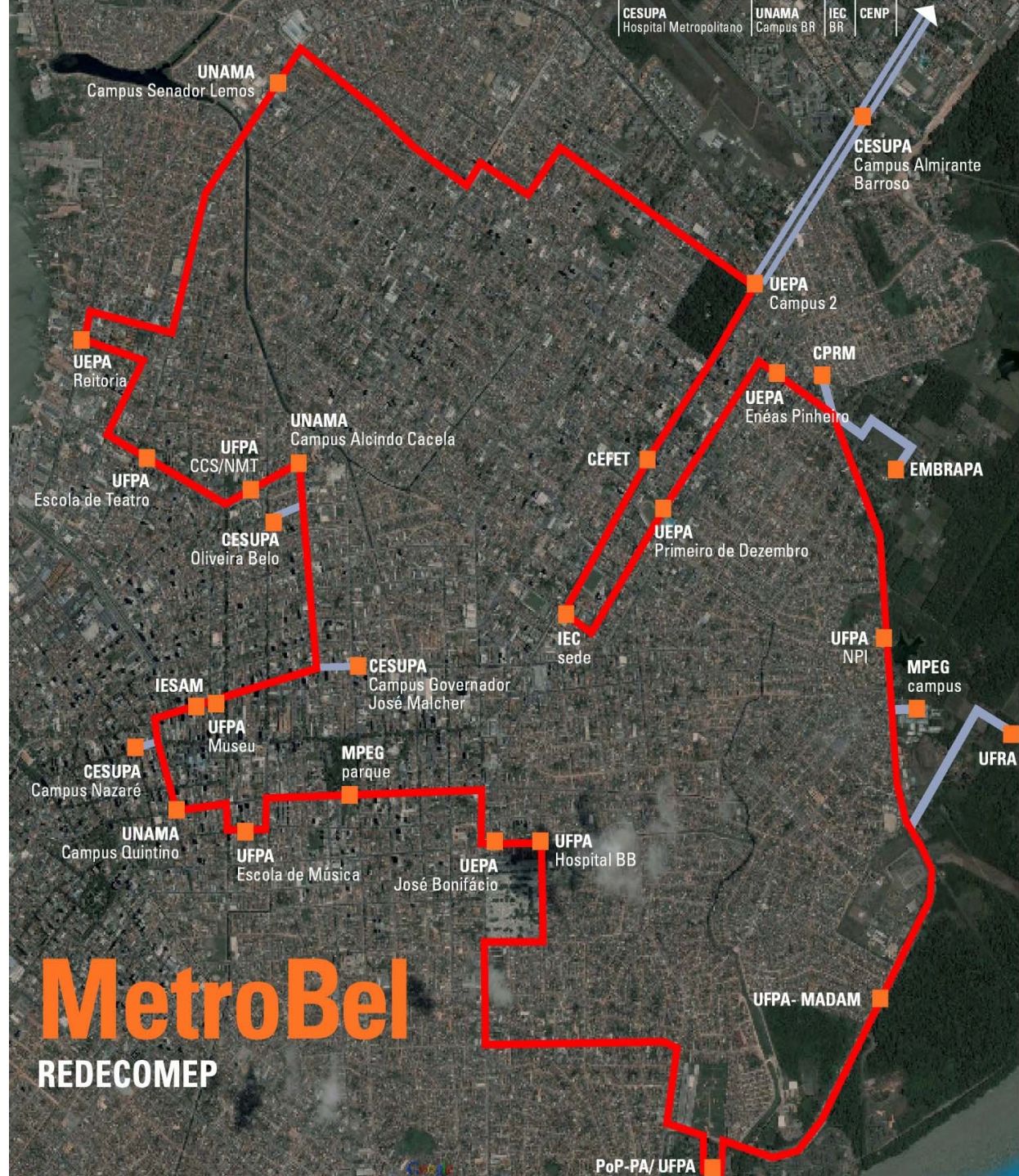
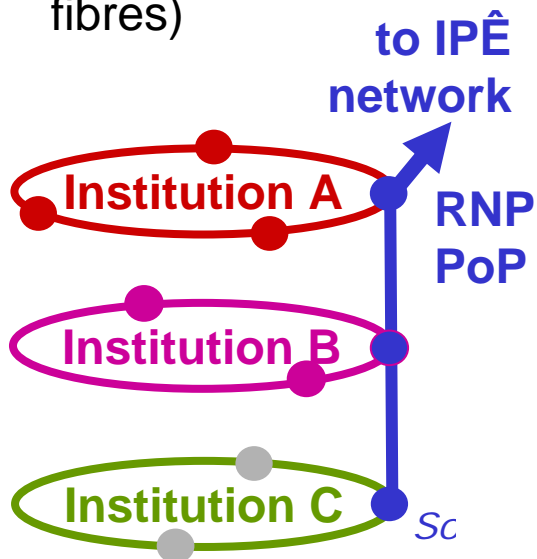
Community-based optical metropolitan networks



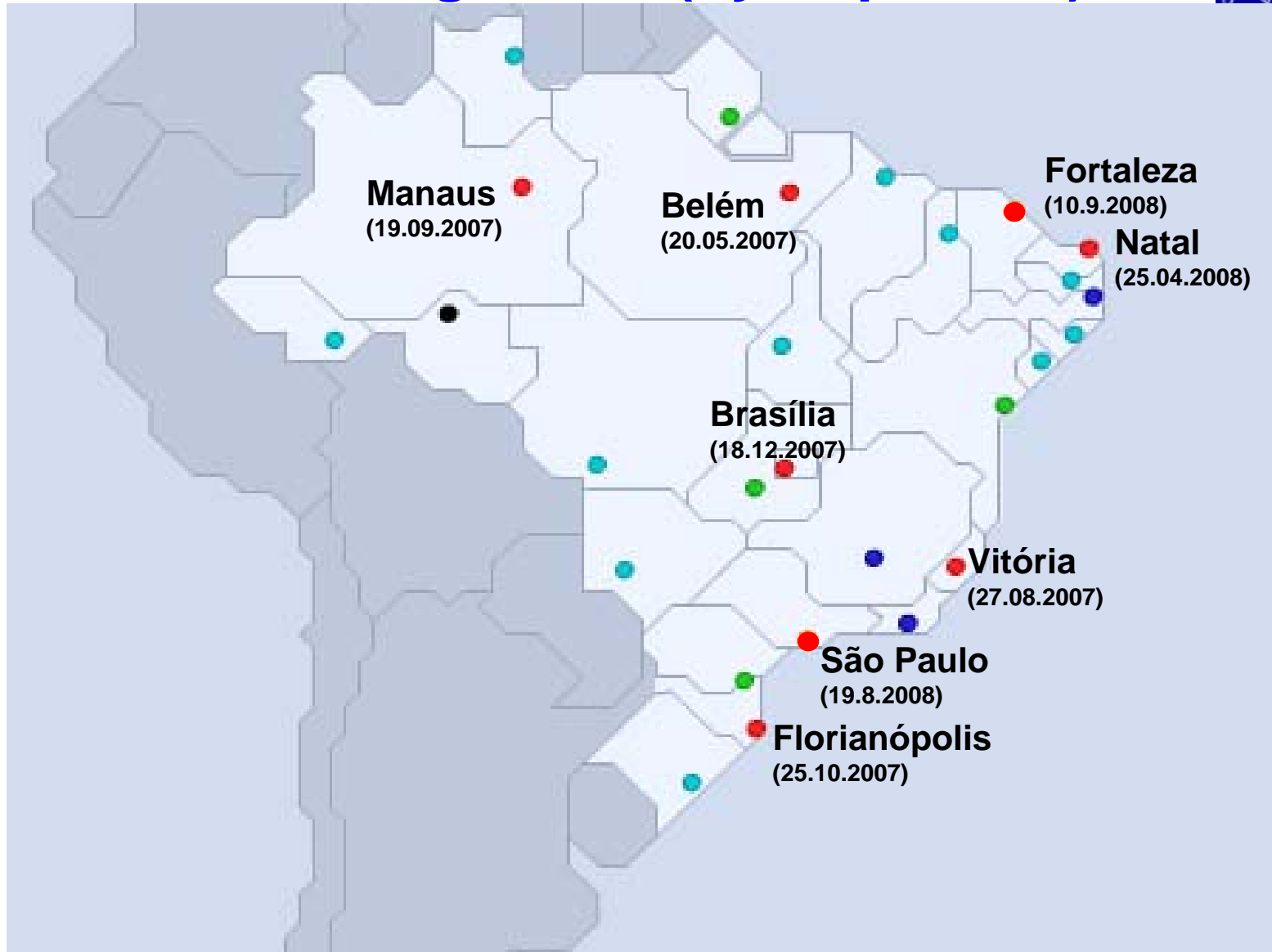
- Since 2004, RNP has also concentrated its attention on metropolitan networks, to provide adequate access to the multigigabit IPÊ network
 - Funding provided by Science and Technology ministry, complemented by contributions from state and city governments and by private R&E participants
- These metro networks are usually based on owned dark fiber networks, shared between the R&E institutions served
 - typically operate at 1 Gbps and permit:
 - interconnection of the campi of the participating institutions
 - access to RNP's IPÊ network PoP
 - reduction of current costs
 - easy to upgrade (e.g. to 10 Gbps) – just replace the terminal equipment
- Pilot project: o projeto MetroBel na cidade de Belém do Pará, whose metropolitan area has a population of 2.2 millions
 - network was inaugurated in May 2007
- All 27 capital city metro networks to be installed by 2009

MetroBel

- 12 institutions with 32 campi
- each institution has its own pair of fibers (for internal connectivity)
- 30 km ring (48 fibres)
- 10 km extension to Ananindeua (36 fibres)
- 12 km access links (6 fibres)



Networks Inaugurated (by Sept 2008) ●

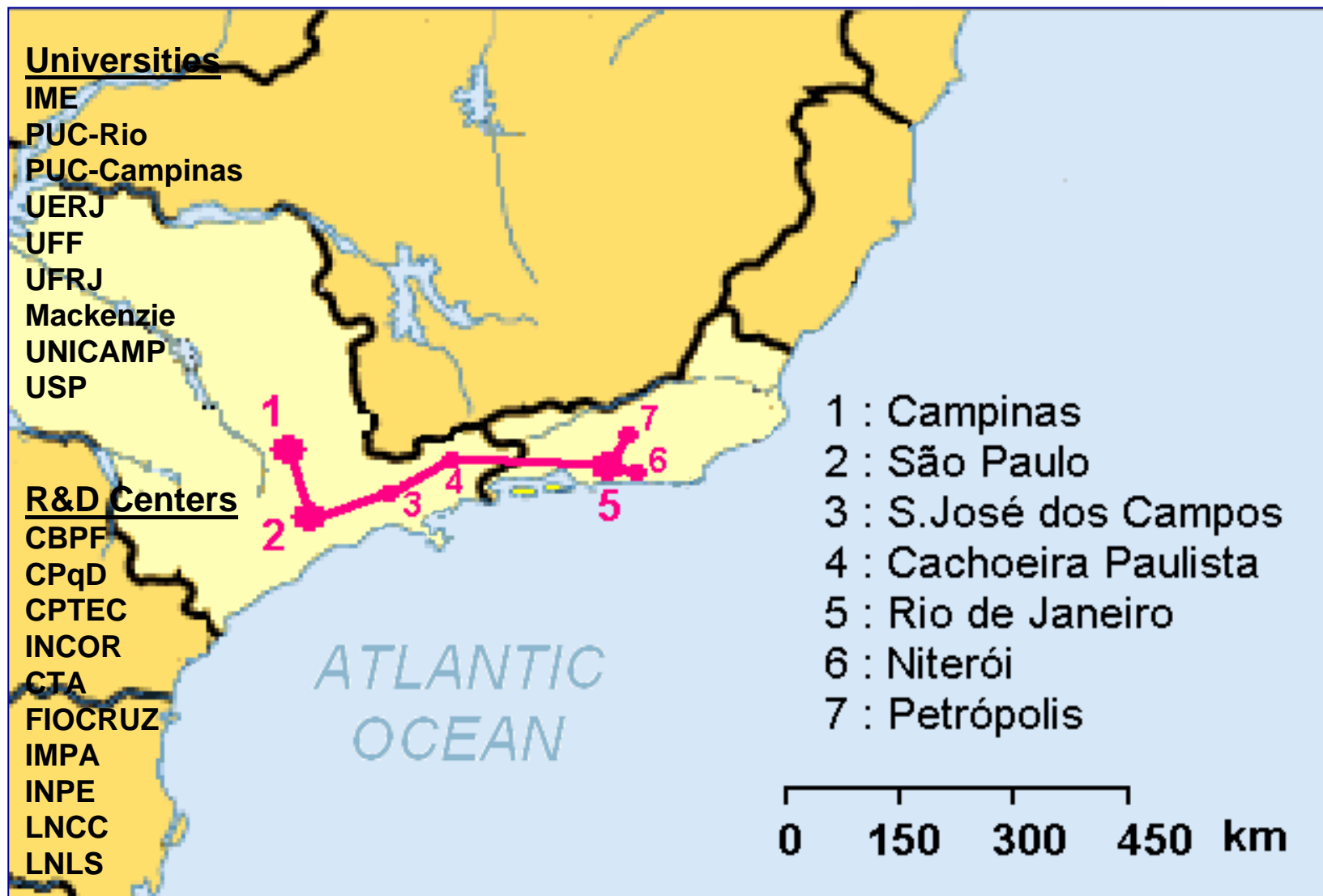


Project GIGA – optical networking testbed



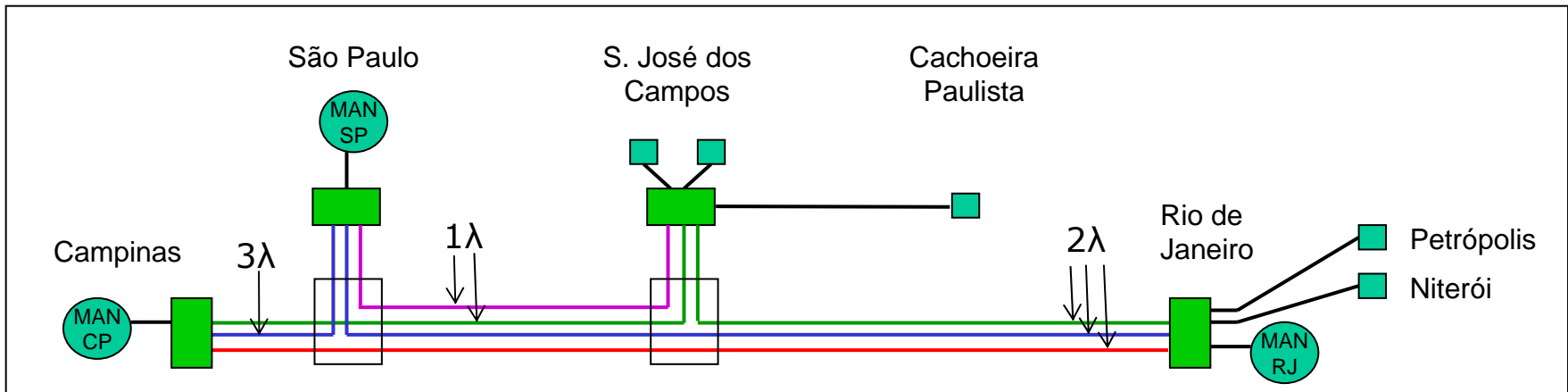
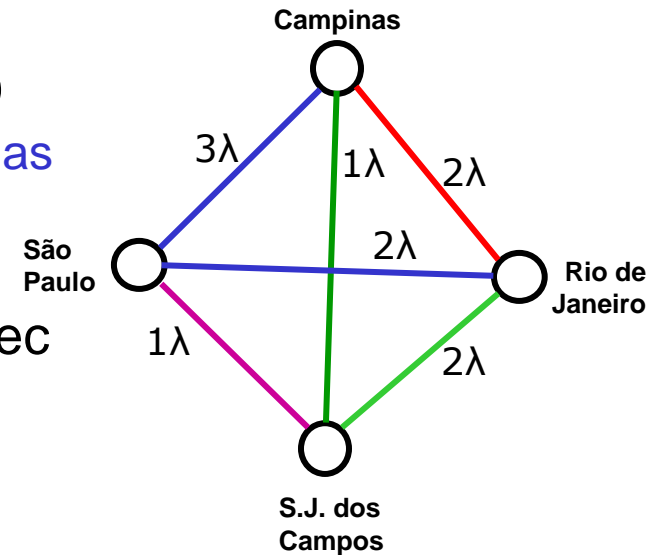
- Partnership between
 - RNP
 - CPqD (telco industry R&D centre in Campinas, SP)
www.cpqd.com.br
 - R&D community in industry and universities
- Objectives:
 - build an advanced networking testbed for development and demonstration purposes
 - support R&D subprojects in optical and IP networking technology and advanced applications and services
- Industry participation
(telcos provide the fibres without cost; technology transfer of products and services to Brazilian Industries and telcos required)
- Government funding for equipment and R&D activities (2003-2008)

GIGA testbed network – location

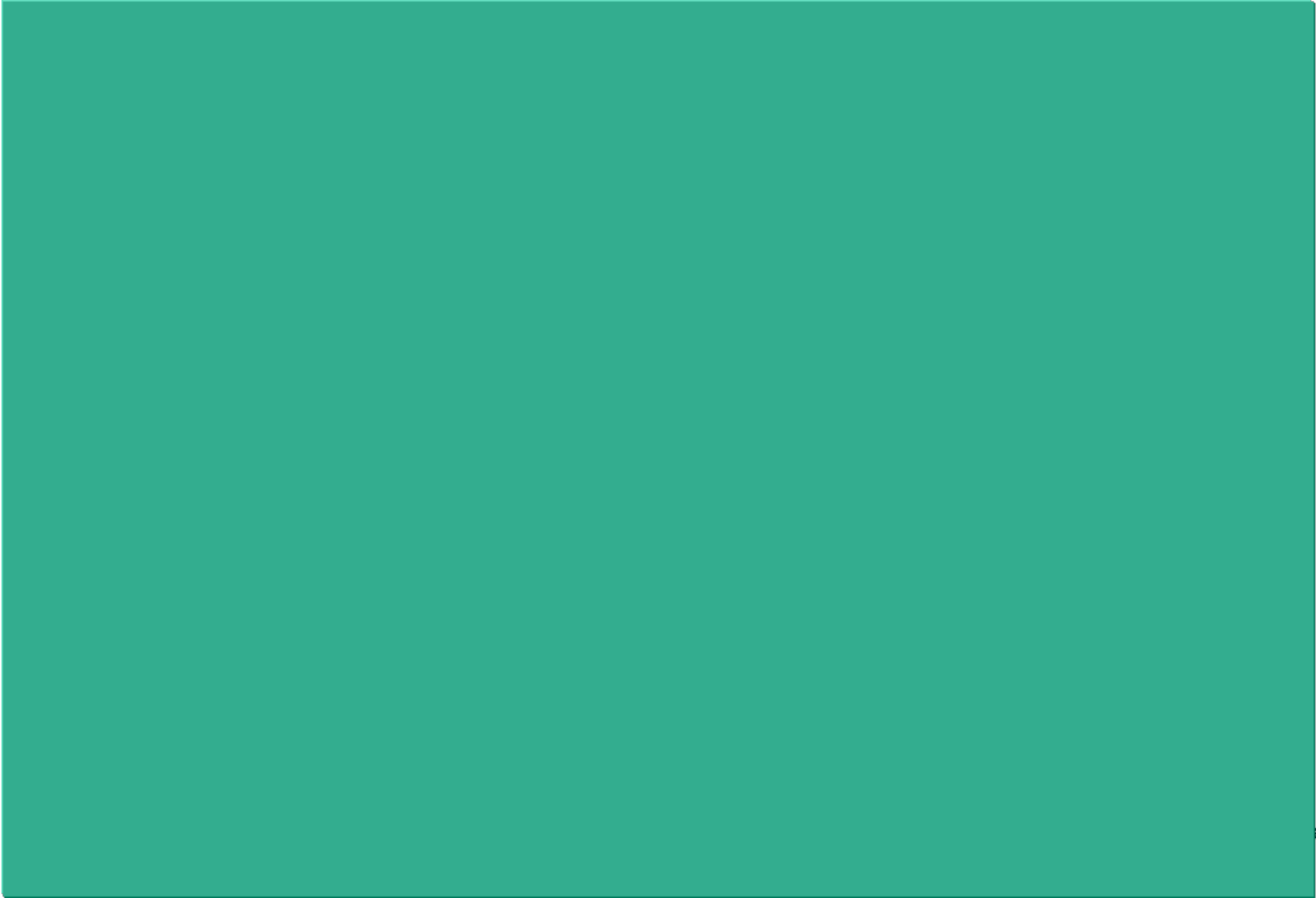


Testbed network design

- Initially 2.5G DWDM inter-city network between Campinas and Rio de Janeiro (upgrading to 10G)
 - up to 6 waves per link (can use 8 or more)
- 2.5G CWDM metro networks in São Paulo, Campinas and Rio de Janeiro
- all Layer 2 links currently 1 Gigabit Ethernet
 - layer 1 equipment from the Brazilian firm, Padtec (www.padtec.com.br)
 - layer 2/3 equipment from Extreme Networks



KyaTera research network in SP state



KyaTera: details



- Dark fibre network from carrier (Telefonica)
- Layer 1 equipment (ROADM) from PadTec
- Layer 2 equipment (Ethernet) from Datacom
 - 10G channels between São Paulo, Campinas and São Carlos
 - 1G on other links
- External connections to US (WHREN/LILA) and nationally (via RNP networks)
- Research programme included network development

Southern Light (SOL) GOLE

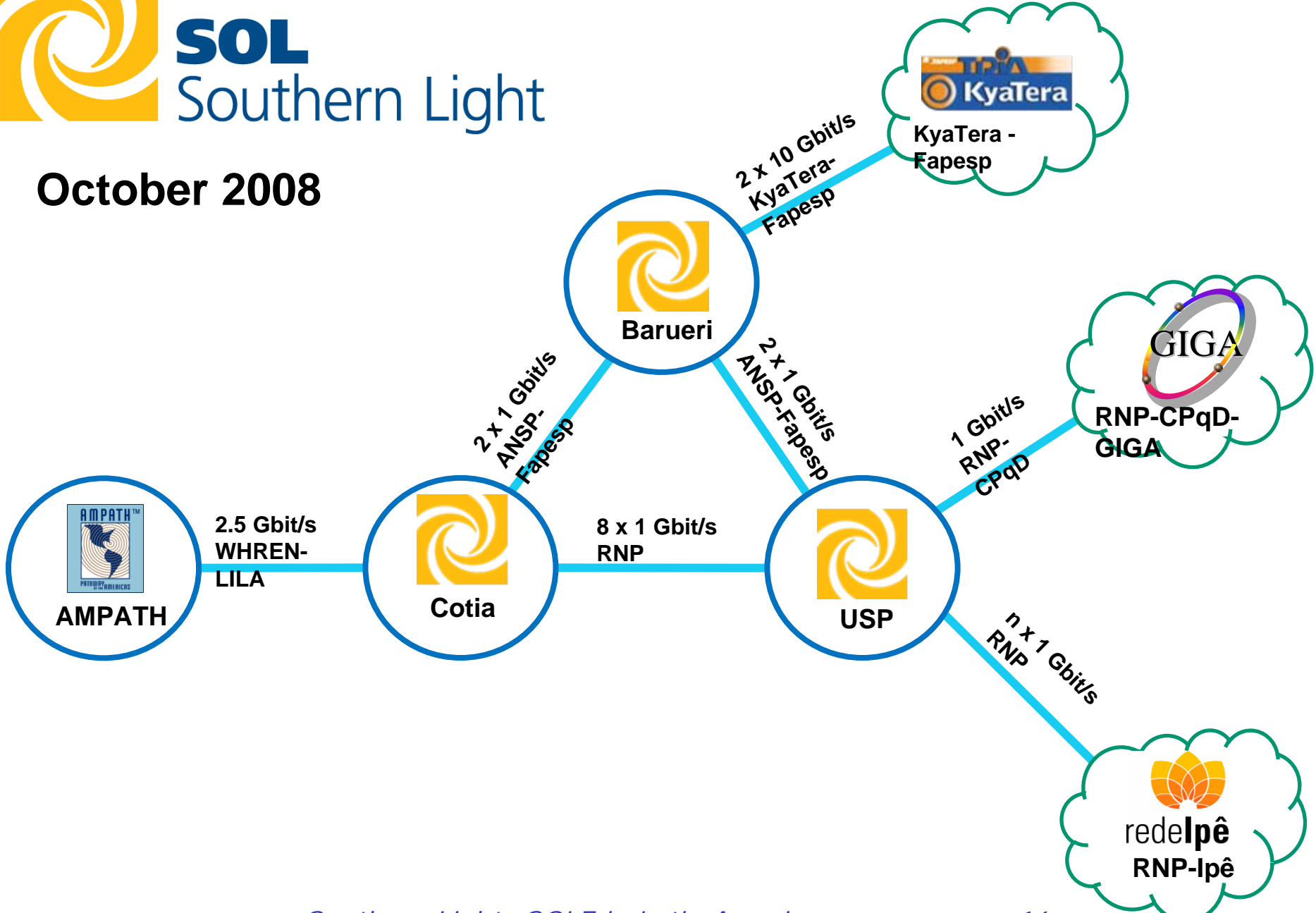


- This GOLE interconnects the 3 Brazilian participating networks, linking them to the WHREN-LILA link to the AMPATH GOLE in Miami
- SOL is co-administered by ANSP and RNP, the Brazilian partners in the WHREN-LILA project
- Distributed GOLE: not all 3 networks and WHREN-LILA are co-located, so initially there are 3 interconnected sites with redundant links.
 - U of São Paulo (USP) – the RNP PoP in São Paulo
 - Cotia – PoP of Global Crossing's network
 - Barueri – Terremark's NAP of Brazil
- With upcoming upgrades, this should be reduced to 2 by next month.



SOL Southern Light

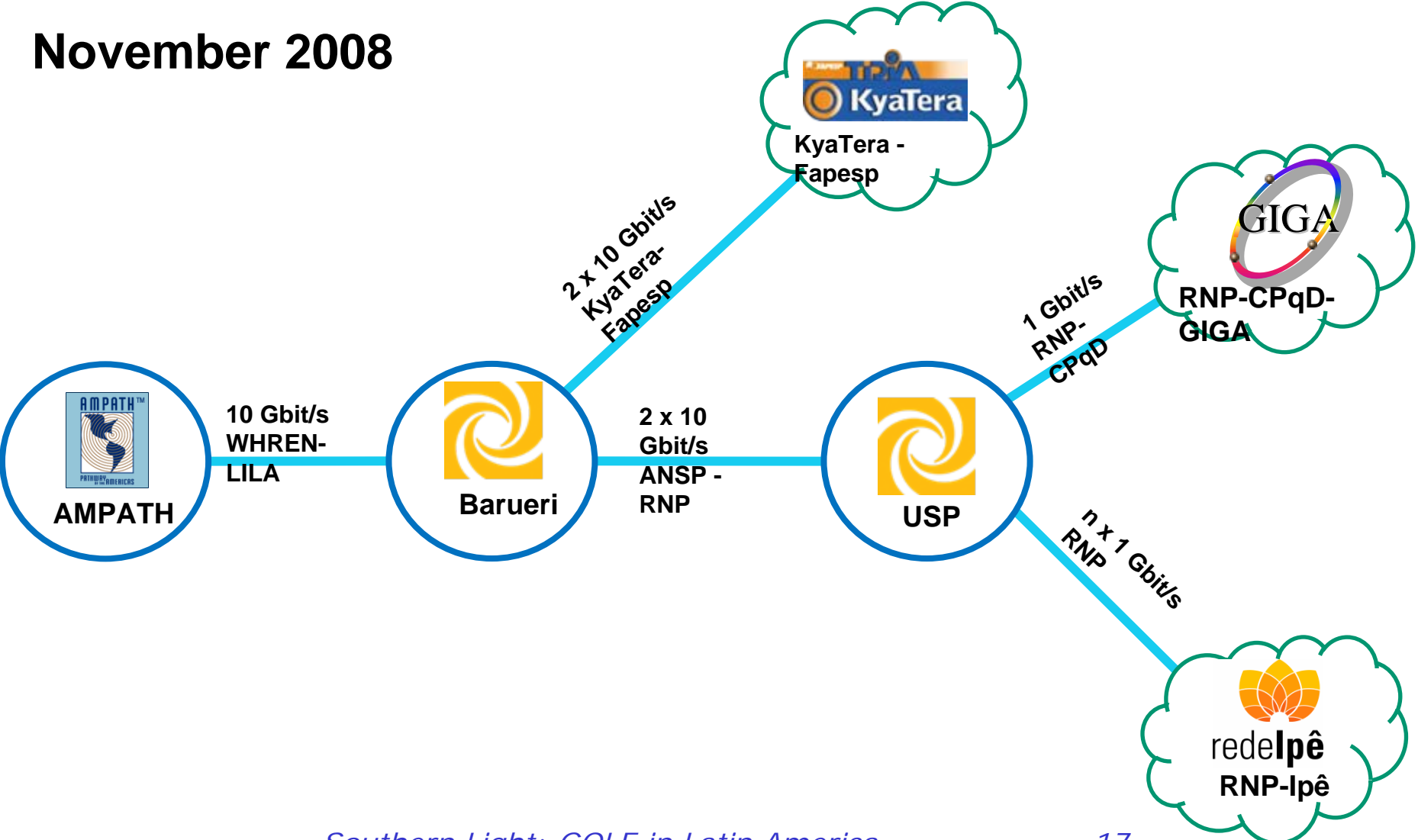
October 2008





SOL Southern Light

November 2008



Initial use of international L2 circuits



- October 2007: RNP collaborated with i2Cat (Catalonia, Spain) to participate in the Artfutura event in Barcelona.
 - 100 Mbps circuit manually provisioned between Rio de Janeiro and Barcelona
 - domains involved: RNP-GIGA, RedCLARA, GEANT, RedIris, i2Cat
- January 2008: LHC/CMS collaboration requested circuits between CERN and UNESP (São Paulo) and UERJ (Rio) in Brazil
 - domains involved: RNP-GIGA, RNP-Ipê, AMPATH, A-Wave, MAX, Starlight, ManLan, Netherlight, CERN
- Probable future use for e-VLBI collaboration between MIT and ROEN observatory near Fortaleza, Ceará (initial phase)

Future developments



- All three Brazilian networks involved are in the process of upgrading their links and technologies
 - RNP plans is currently tendering for increased capacity on the current multi-Gbps core and for including 5 more PoPs
 - RNP has initiated planning of its next national network (2009-10) based on hybrid packet-circuit architecture, in order to interoperate with international partners
 - GIGA testbed will be used to prototype and study alternatives
 - KyaTera has similar plans, announced at GLIF2007
- An important component is access to wide area fibre/waves
 - several projects under study for achieving this, first demonstrated in the northern state of Pará

Navega Pará – a statewide optical network



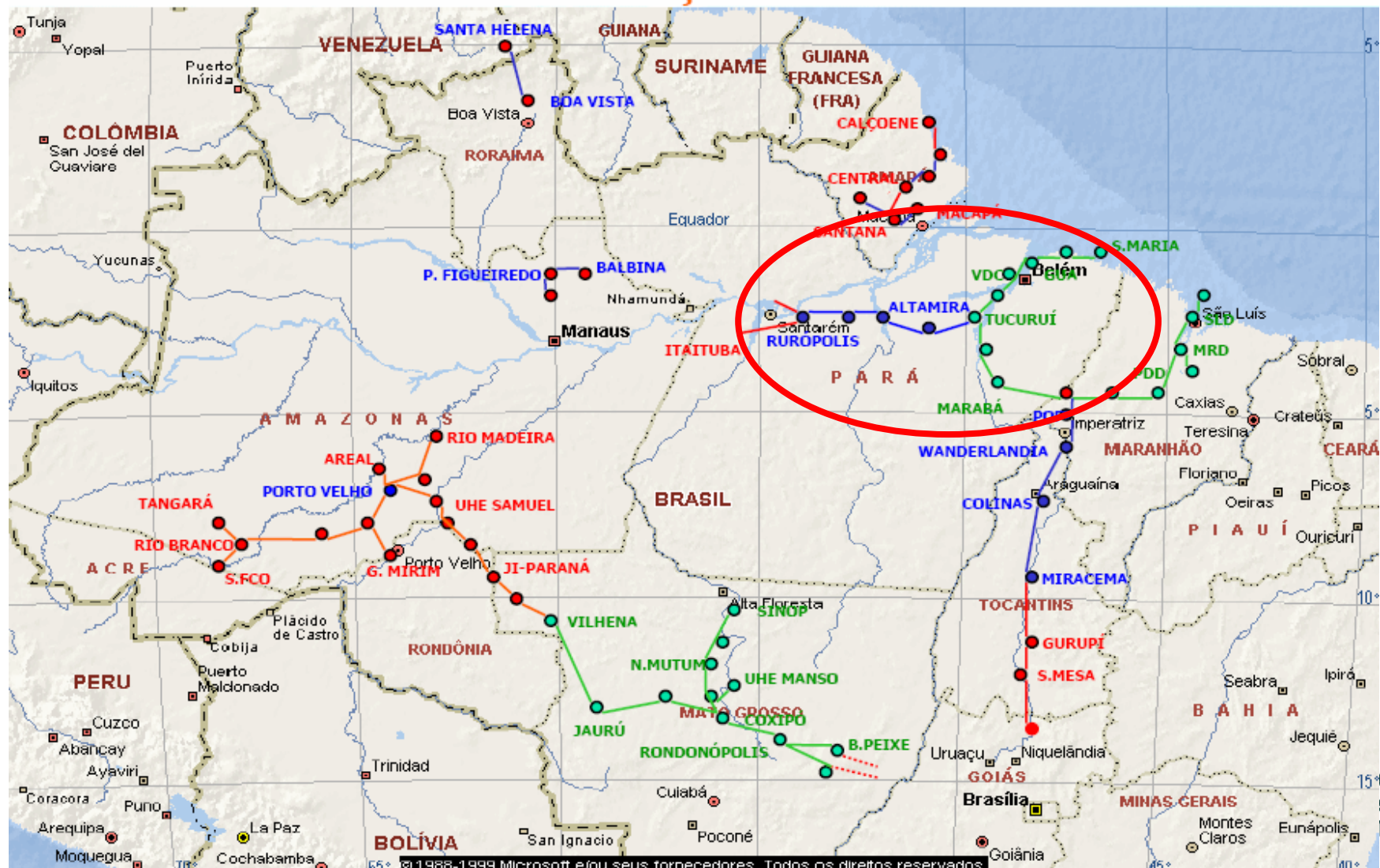
- <http://www.navegapara.pa.gov.br/> (only in Portuguese)
- After the success of the Metrobel project in the capital, Belém, the state government decided to extend advanced networking to the rest of the state
 - Collaboration with the electric companies (Eletronorte and Rede Celpa), which have their own OGPW installed
 - The state government is paying for installing 8-wave 10G DWDM systems, and splitting the capacity with the owner of the fibre
 - Network to be used for research and education, as well as government and social inclusion objectives
- A similar scheme is also being carried out in Ceará state (capital: Fortaleza)

Optical fibre in Pará state



CENTRAIS ELÉTRICAS DO NORTE DO BRASIL S/A - ELETRONORTE

Comunicações na Amazônia



A paradigm for future expansion



- RNP and its partners are actively seeking similar opportunities with utility companies (and others) with fibre assets, to encourage similar projects
 - As state schemes are geographically limited, there is a tendency to create interstate collaborations (cross state border fibres)
- Similar initiatives are also being taken at the regional level, spearheaded by CLARA, the association of Latin American NRENs
 - The first projects in discussion are the links Chile-Argentina and Argentina-Brazil which also involve the corresponding NRENs
 - This could expand GLIF to reach Argentina and Chile soon.
 - Future plans for terrestrial fiber links to the North

RedCLARA2: first optical initiatives

Chile - Argentina



Argentina - Brazil



Conclusion



- GLIF development is proceeding in Brazil, by incorporating and extending current network infrastructure and applications
- The high cost of submarine circuits to Latin America is a brake on speedy increase of international links
- New paradigm for acquiring high-capacity links through collaboration with utility companies in Brazil
- The same thinking applied to the rest of Latin America will determine the future of regional integration and global access



Thank you!

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