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*Onde o futuro
se encontra.*

Projeto Evolução de Testbeds para Redes Abertas

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Evolução de Testbeds para Redes Abertas

O Que?

- Adicionar novas capacidades de experimentação em tecnologias de redes abertas ao serviço de testbeds da RNP

Como?

- Integração de projetos de código aberto

Por Quê?

- Experimentos de referência para serem replicados e alterados pela comunidade

Casos de Uso

- Criação de gêmeo digital da Rede Ipê
- Criação de redes programável usando P4

Equipe

Julho/23 - Fev/2024

- Mariana Maciel – UFRJ

Julho/23 - Fev/2025

- Alan Teixeira - UNICAMP
- Kaio Guilherme – UFRR / PoP-RR

Julho/24 – Fev/2025

- Eduardo Castro – UFRA / PoP-PA
- Rafael Brandão – PoP-GO
- Raimundo Lima – UEMA / PoP-MA



Componentes

[Digitar o título do texto corrido](#)

Netbox: Source of Truth

Containerlab: Laboratórios Virtuais de Rede

Netreplica: Automação e Integração entre Netbox/Containerlab



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Containerlab

Topology file

Declarative way to define a lab

```
name: mylab

topology:
  nodes:
    blue : green
    blue : green

  links:
    - blue : green
```



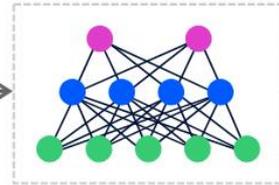
YAML



YAML



CONTAINERlab
containerlab.dev



<https://containerlab.dev>



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Containerlab – Plataformas Suportadas

NOKIA

● srl
● vr-sros

JUNIPER
NETWORKS

● crpd ● vjunos
● vr-vmx
● vr-vqfx

ARISTA

● ceos
● vr-veos

CISCO

● vr-xrv9k ● xrd
● vr-csr
● vr-n9kv

SONiC

● sonic-vs
● frr

NVIDIA

● cvx

paloalto
NETWORKS

vr-pan

DELL

● vr-ftosv

ixia

● keysight_ixia-c

MikroTik

● vr-ros

ipinfusion

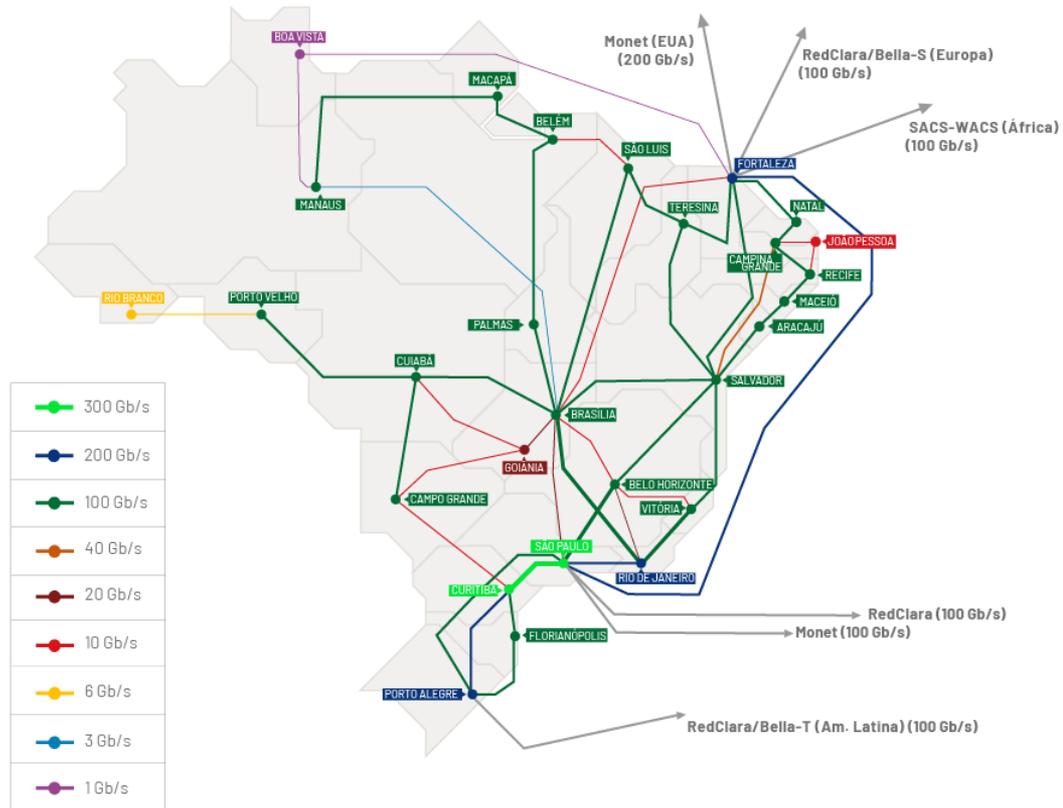
● ipinfusion_ocnos

CHECK POINT

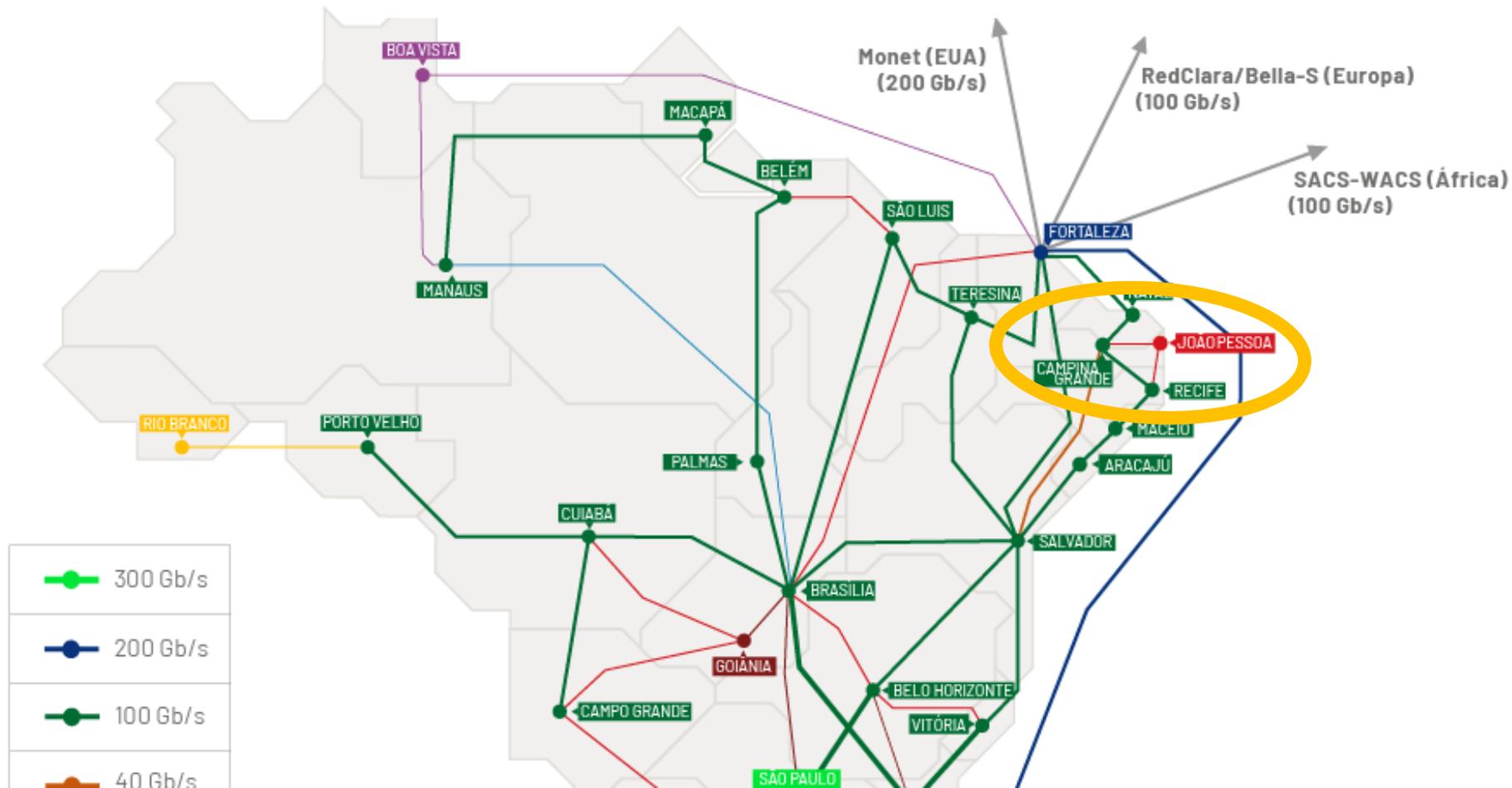
● checkpoint_cloudgard

Caso de Uso - Digital Twin da Rede Ipê

D



Prova de Conceito (PB, PE, JPA)



Vídeo 1 – Netbox de P&D

Digitar o título da imagem

The screenshot shows the Netbox web interface for managing network devices. The main content area displays a table of devices with the following columns: Name, Status, Tenant, Site, Location, Rack, Role, Manufacturer, Type, IP Address, and Tags. Three devices are listed:

| Name | Status | Tenant | Site | Location | Rack | Role | Manufacturer | Type | IP Address | Tags |
|------|--------|--------|--------|----------|------|------|--------------|------|------------|----------|
| JPA | Active | — | PA-PB | — | — | Core | Juniper | MX | — | RNP-CORE |
| PB | Active | — | PoP-PB | — | — | Core | Juniper | MX | — | RNP-CORE |
| PE | Active | — | PoP-PE | — | — | Core | Juniper | MX | — | RNP-CORE |

The interface also includes a sidebar with navigation options, a search bar, and action buttons like '+ Add', '+ Import', and '+ Export'. The video player controls at the bottom show the video is at 00:00:13 and has a total duration of 00:00:46.

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Vídeo 1 – Netbox de P&D



The screenshot displays the NetBox web interface. The left sidebar contains a navigation menu with the following items: Organization, Devices, Connections, Wireless, IPAM, VPN, Virtualization, Circuits, Power, Provisioning, Customization, Operations, and Admin. The main content area is divided into several widgets:

- Organization:** Sites (3), Tenants (1), Contacts (0)
- Circuits:** Providers (0), Circuits (0), Provider Networks (0)
- Virtualization:** Clusters (0), Virtual Machines (0)
- IPAM:** VRFs (2), Aggregates (0), Prefixes (0), IP Ranges (0), IP Addresses (6), VLANs (0)
- DCIM:** Sites (3), Racks (0), Device Types (1), Devices (3), Cables (3)
- Welcome!** A message box with instructions on how to customize the dashboard.
- NetBox News:** A section with two news items: "Announcing the NetBox Labs Resource Center" and "The State of Network Automation in 2024".
- Change Log:** A table showing recent changes.

| Name | Status | Tenant | Site | Location | Rack | Role | Manufacturer | Type | IP Address | Tags |
|------|--------|--------|--------|----------|------|------|--------------|------|------------|----------|
| JPA | Active | — | PA-PB | — | — | Core | Juniper | MX | — | RNP-CORE |
| PB | Active | — | PoP-PB | — | — | Core | Juniper | MX | — | RNP-CORE |

Netreplica / Topoliga Gerada

1

```
dtn01:/nrx# ./nrx.py -c rnp.conf
Connecting to NetBox at: https://nbx.rnp.nmaas.eu/
Fetching devices with tags: rnp-core
Created clab topology: rnp/rnp-core.clab.yaml
To deploy this topology, run: sudo -E clab dep -t rnp/rnp-core.clab.yaml
```

2

```
├─ clab-rnp-core
│  ├── ansible-inventory.yml
│  ├── authorized_keys
│  ├── JPA
│  │   ├── config
│  │   │   ├── juniper.conf.gz
│  │   │   ├── license
│  │   │   │   ├── conf
│  │   │   │   └── safenet
│  │   └── sshd_config
│  └── log
├── PB
│   └── ...
├── PE
│   └── ...
└── topology-data.json
rnp-core.clab.yaml
```

3

```
name: rnp-core-ospf
topology:
  nodes:
    graphite:
      kind: linux
      image: netreplica/graphite:latest

    PE:
      kind: juniper_vmx
      image: vr-vmx:22.2R1.9
      startup-config: PE.config

    PB:
      kind: juniper_vmx
      image: vr-vmx:22.2R1.9
      startup-config: PB.config

    JPA:
      kind: juniper_vmx
      image: vr-vmx:22.2R1.9
      startup-config: JPA.config

  links:
    - endpoints: ["PE:eth1", "PB:eth1"]
    - endpoints: ["PE:eth2", "JPA:eth2"]
    - endpoints: ["PB:eth2", "JPA:eth1"]
```



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Vídeo 2 – Laboratório Virtual



localhost:8080/graphite/

netrelica Diagram Help

Containertab Topology **mp-core-ospf**

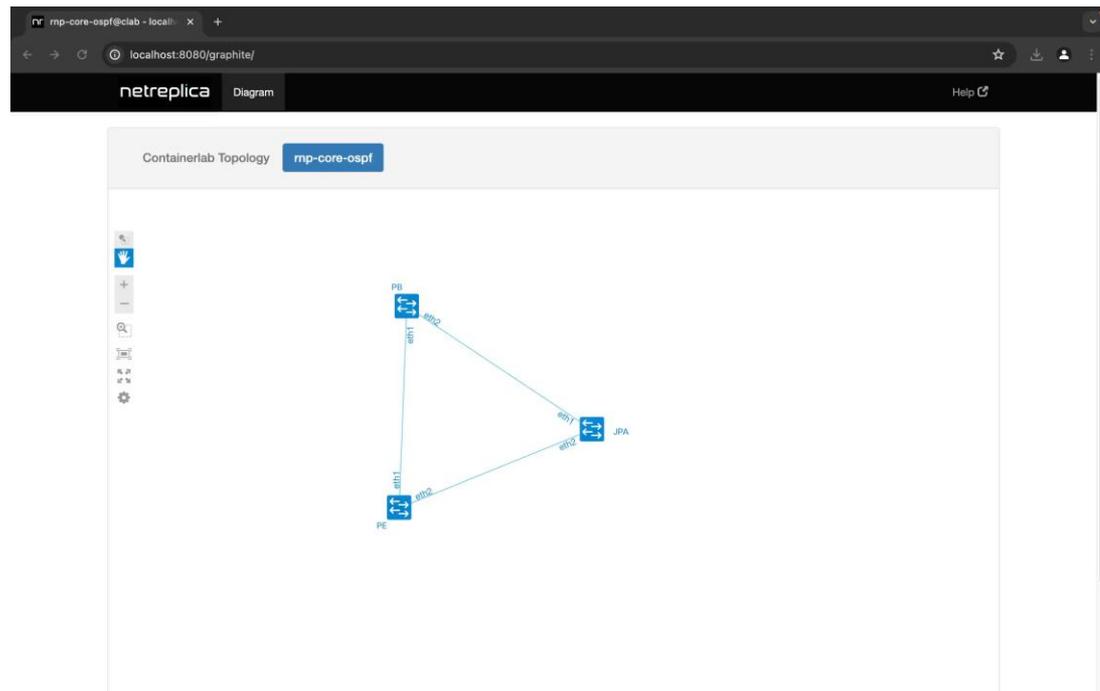
```
graph TD; PB[PB] --- eth1 --- PE[PE]; PB --- eth2 --- JPA[JPA]; PE --- eth1 --- JPA; PE --- eth2 --- JPA;
```

00:00:00

graphite-2

00:01:33

Vídeo 2 – Laboratório Virtual



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Próximos Passos

Definição dos desafios

- Source of Truth Multi Domínio
- Observabilidade
- Automação / Orquestração
- Redes Virtuais de Alto Desempenho
- Dataplane Programability



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OBRIGADO (A)!

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