



25^o

Workshop
RNP

*Onde o futuro
se encontra.*

Projeto Evolução de Testbeds para Redes Abertas

Marcos Schwarz

Gerente de P&D em Ciberinfraestrutura

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



25

Workshop
RNP

Containerlab

Topology file

Declarative way to define a lab

```
name: mylab

topology:
  nodes:
    blue : green
    blue : green

  links:
    - blue : green
```



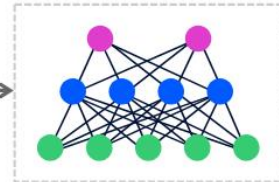
YAML



YAML



CONTAINERlab
containerlab.dev



<https://containerlab.dev>



25

Workshop
RNP

Containerlab – Plataformas Soportadas

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

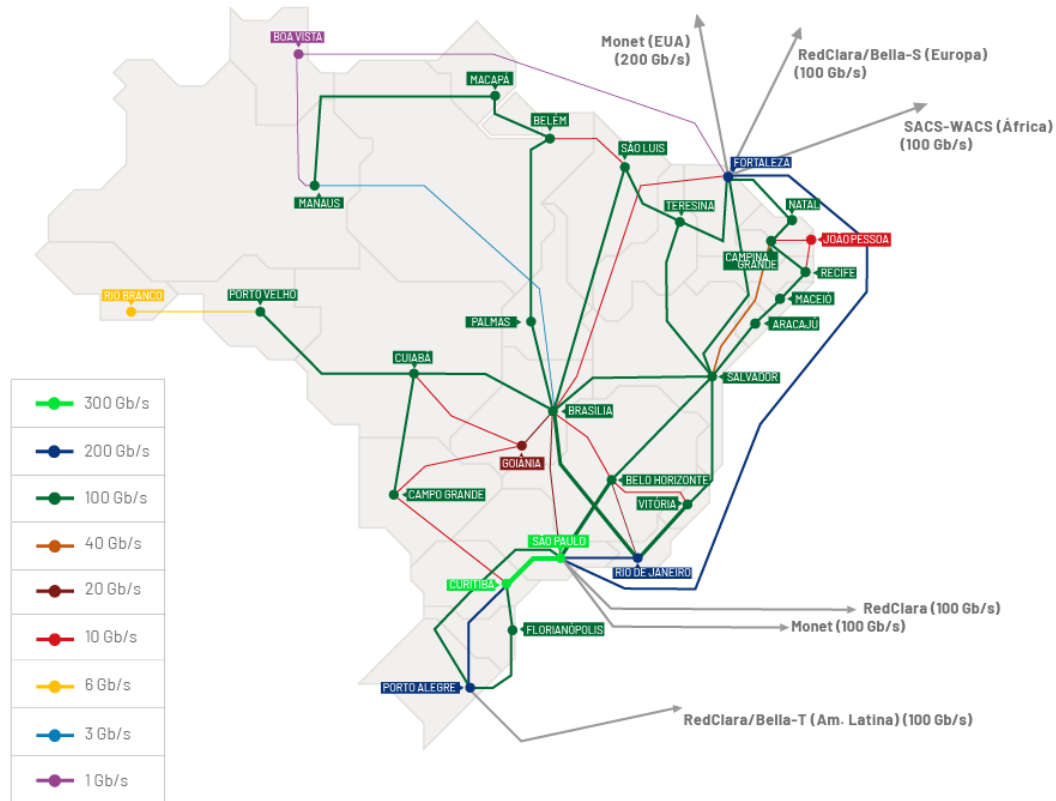
● ipinfusion_ocnos

CHECK POINT

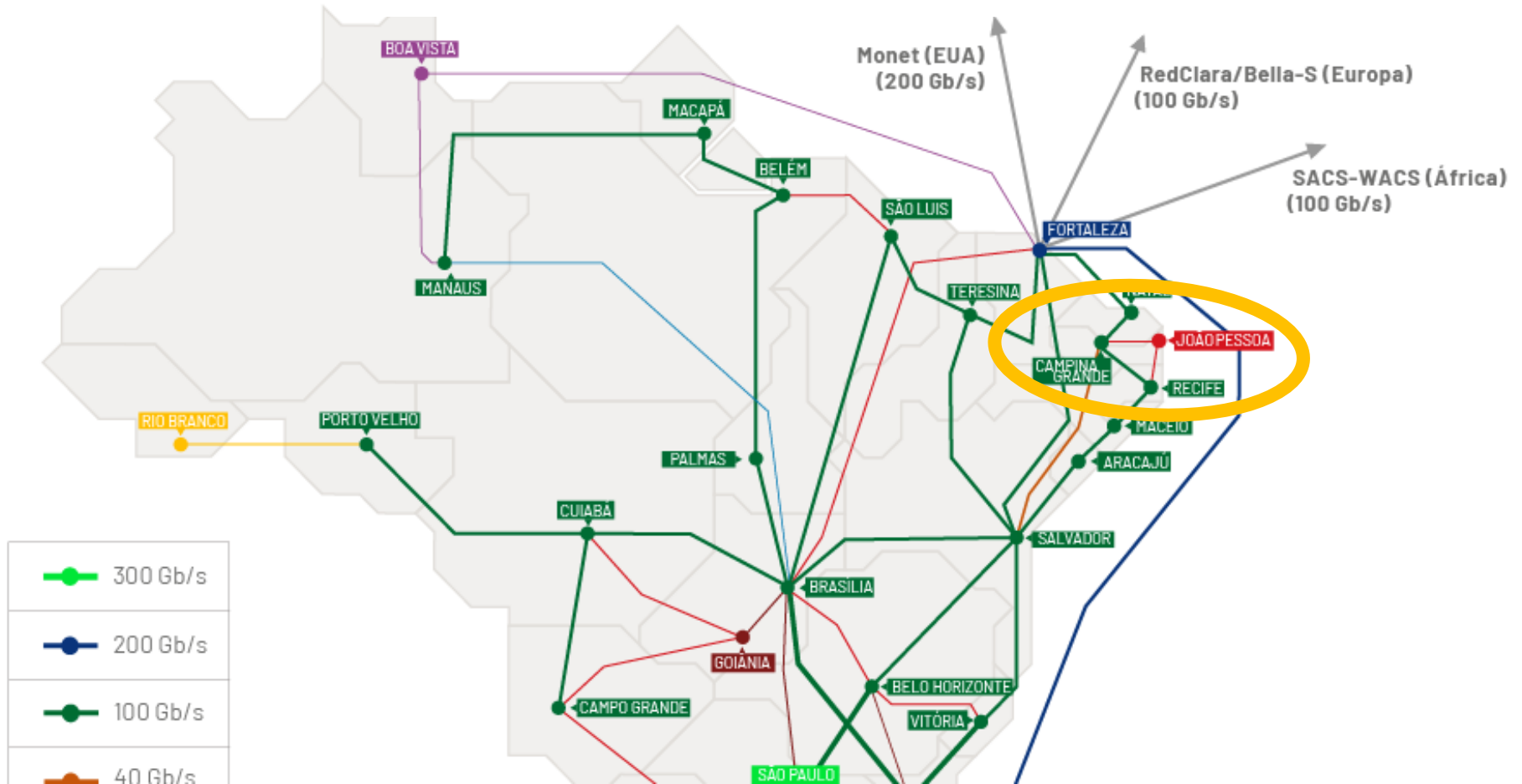
● checkpoint_cloudgard

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 data:

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 a video player overlay at the bottom.

25
Workshop
RNP

Vídeo 1 – Netbox de P&D



The screenshot displays the NetBox web interface. The left sidebar contains navigation links for Organization, Devices, Connections, Wireless, IPAM, VPN, Virtualization, Circuits, Power, Provisioning, Customization, Operations, and Admin. The main content area features 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)

A "Welcome!" widget provides instructions on customizing the dashboard. A "NetBox News" widget contains two articles: "Announcing the NetBox Labs Resource Center" and "The State of Network Automation in 2024".

The "Change Log" widget at the bottom displays a table of 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"]
```



25

Workshop
RNP

Vídeo 2 – Laboratório Virtual



localhost:8080/graphite/

netrelica Diagram Help

Containertab Topology **mp-core-ospf**

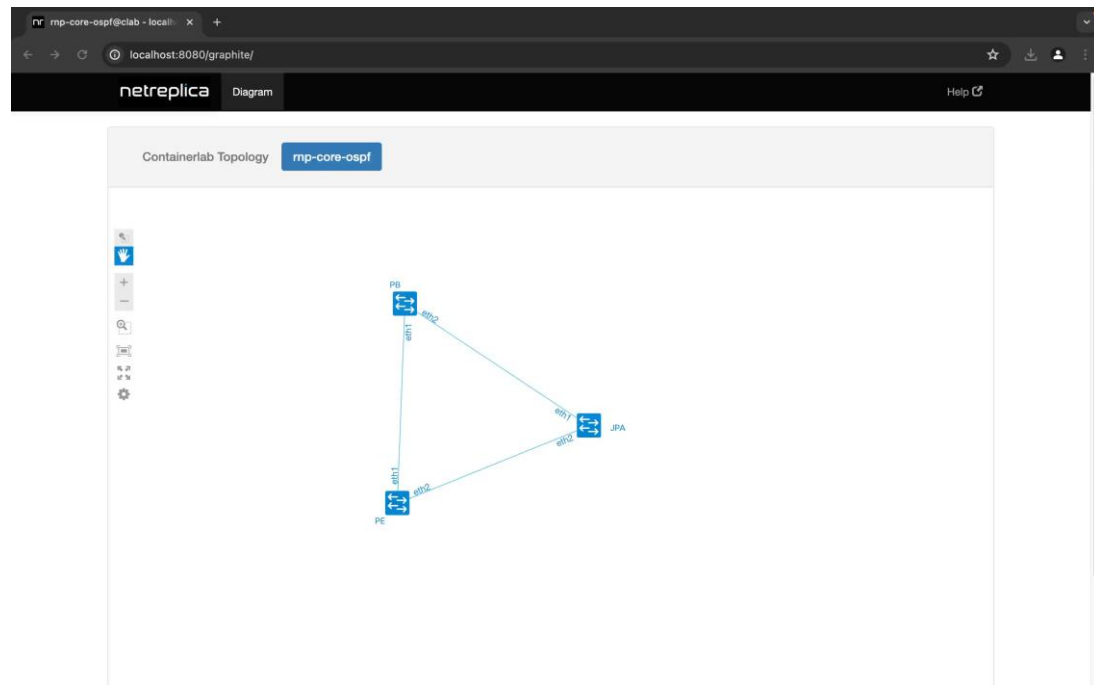
```
graph TD; PB[PB] --- eth1 --- PE[PE]; PB --- eth2 --- JPA[JPA]; PE --- eth1 --- JPA; PE --- eth2 --- JPA;
```

00:00:00

graphite-2

00:01:33

Vídeo 2 – Laboratório Virtual



25
Workshop
RNP

Próximos Passos

Definição dos desafios

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



25

Workshop
RNP



25^o

Workshop
RNP

OBRIGADO (A)!

marcos.schwarz@rnp.br

RNP

MINISTÉRIO DA
CULTURA

MINISTÉRIO DA
DEFESA

MINISTÉRIO DA
SAÚDE

MINISTÉRIO DAS
COMUNICAÇÕES

MINISTÉRIO DA
EDUCAÇÃO

MINISTÉRIO DA
CIÊNCIA, TECNOLOGIA
E INOVAÇÃO

GOVERNO FEDERAL
BRASIL
UNIÃO E RECONSTRUÇÃO