Building multivendor network labs with Containerlab

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Network labs

A right, not a privilege

1

Change management

2

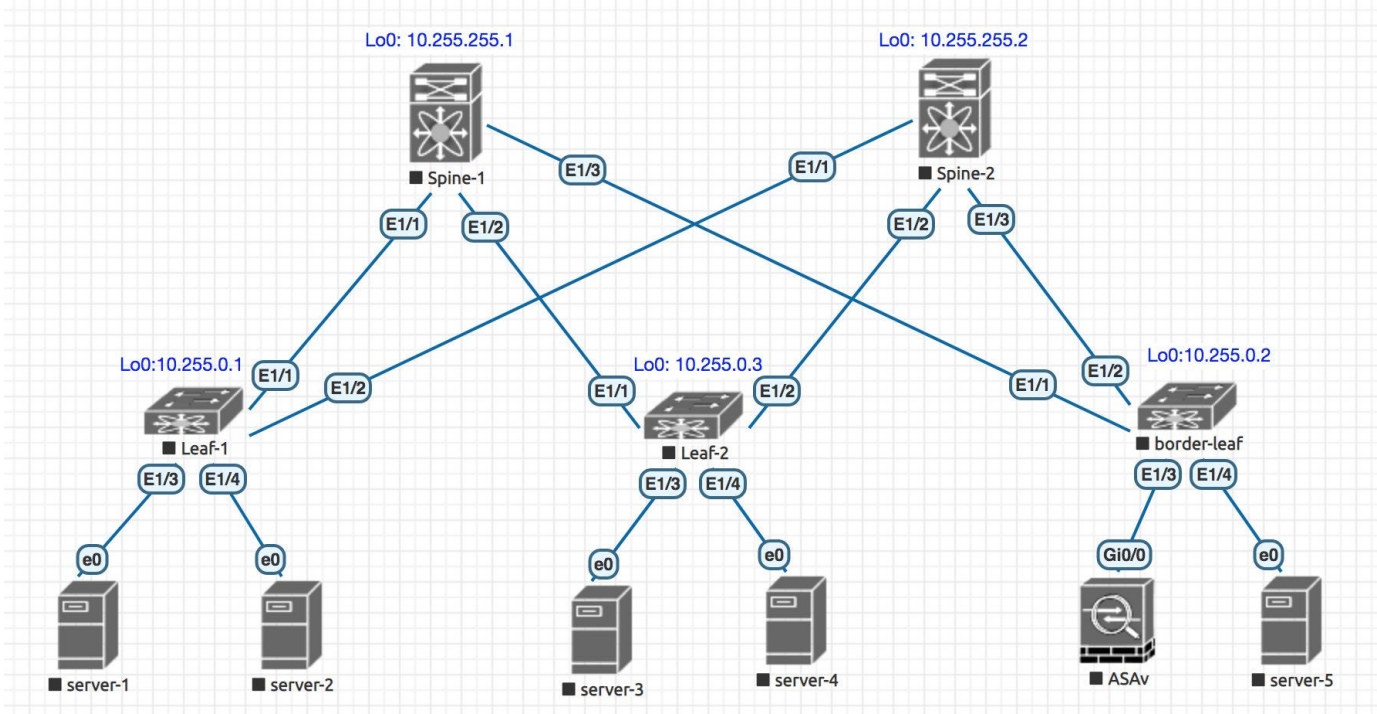
Prototyping and validation

3

Learning

Network labs

How do we typically run labs today?



Pic from https://www.reddit.com/r/networking/comments/g5fb23/eveng_lab_strage_packet_loss/

NOKIA

What else do you need?

Declarative format

What else do you need?

Declarative format

Git friendly

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Declarative format

Portability

Git friendly

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CI/CD Integration

What else do you need?

Declarative format

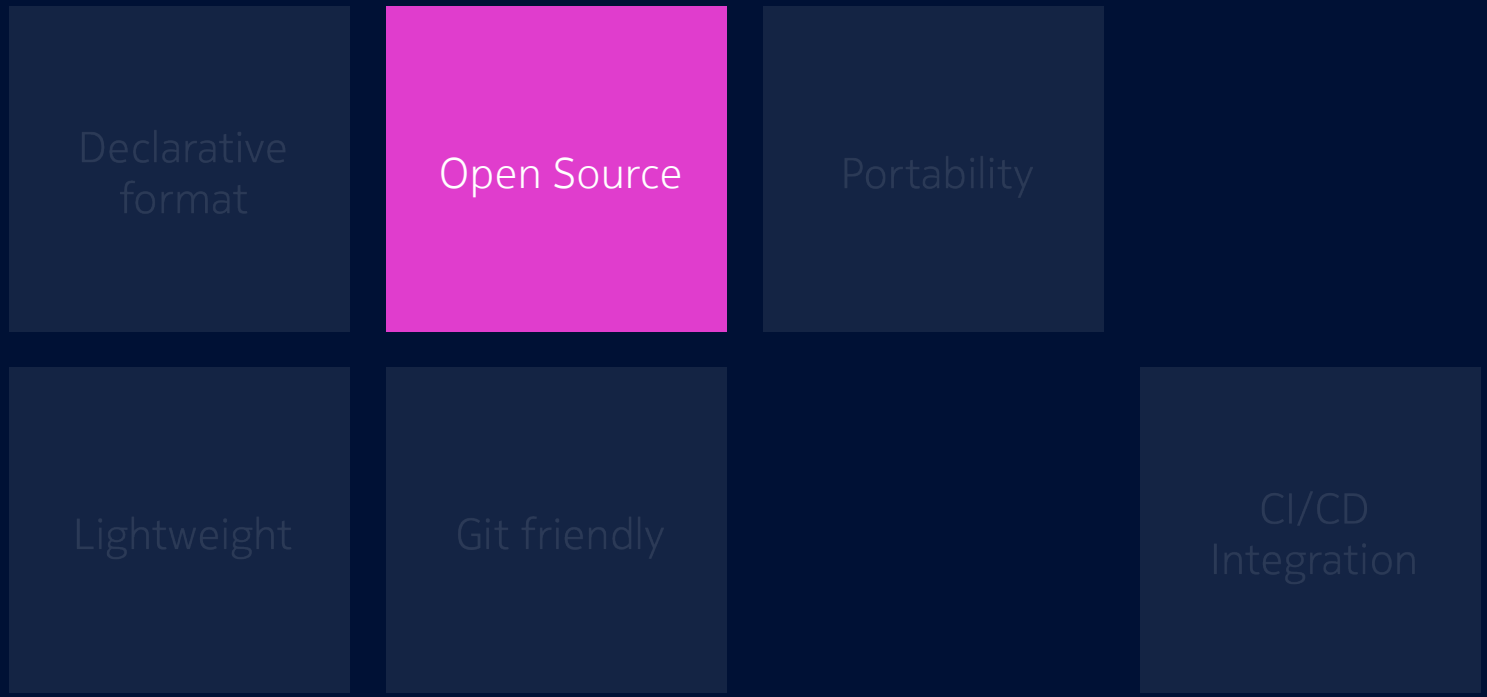
Portability

Lightweight

Git friendly

CI/CD Integration

What else do you need?



What else do you need?

Declarative format

Open Source

Portability

Lightweight

Git friendly

Easy to share

CI/CD Integration

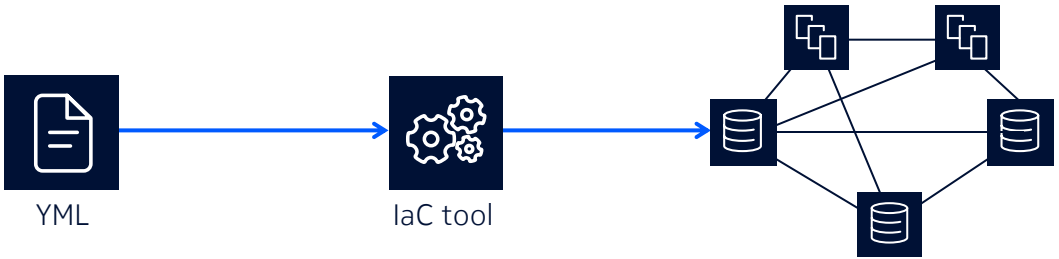
What else do you need?

Declarative format	Open Source	Portability	Container-centric
Lightweight	Git friendly	Easy to share	CI/CD Integration

Containerlab

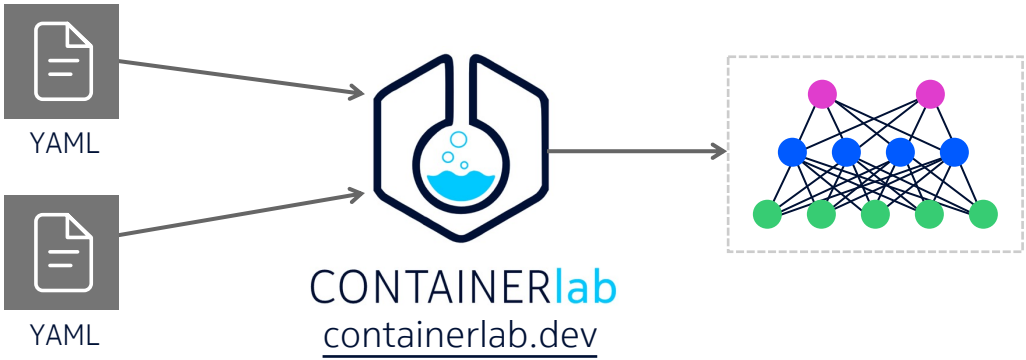
Bringing declarativeness to network labs

IT



Network labs

```
name: mylab

topology:
  nodes:
    [redacted]
    [redacted]

  links:
    - [redacted]
```



Why Containerlab if we have lab emultion tools already?

Network emulation SW

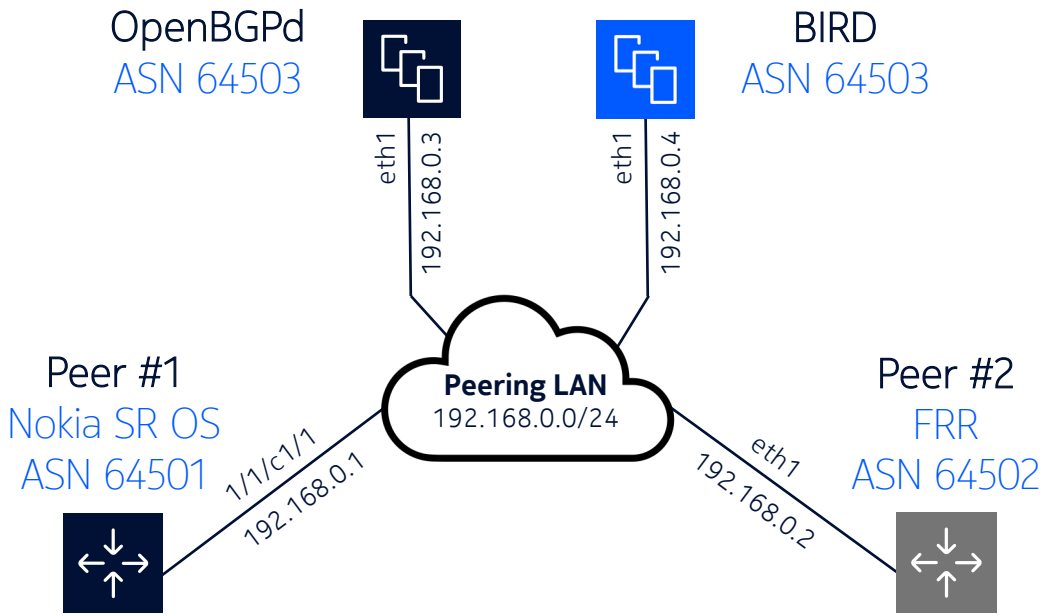
- ⊕ Purpose built and proven
- ⊕ Free versions available
- ⊕ UI
- ⊖ VM-centric weak containers support
- ⊖ Heavy and semi-open
- ⊖ UI

Containerlab

- ⊕ First class support for containerized NOSes
- ⊕ Transparent datapath
- ⊕ Git friendly and better image sharing and handling
- ⊕ Repeatable lab builds and CI friendly
- ⊕ Small footprint, open, free and fast
- ⊖ Fewer Network OSes supported
- ⊖ No UI

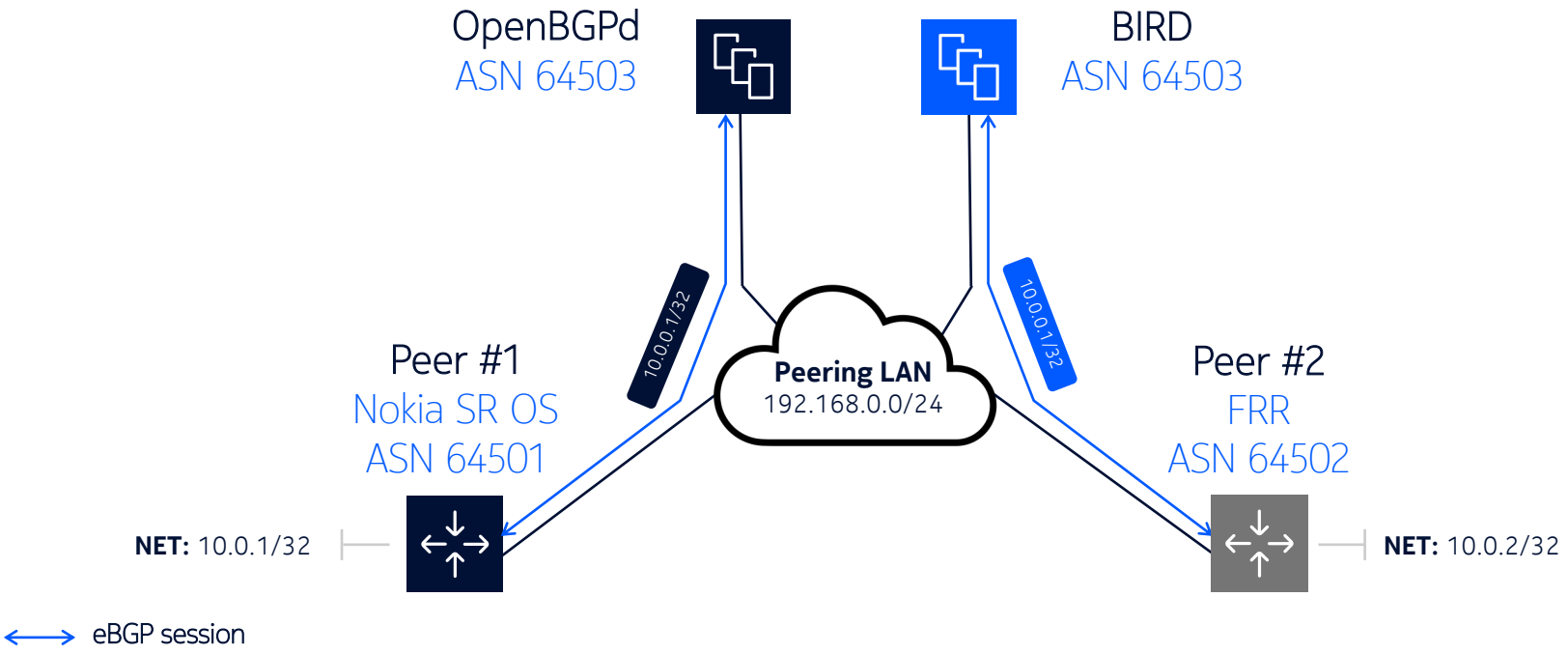
Learn by doing

Basic IXP topology with route servers



Learn by doing

Basic IXP topology with route servers



Installation

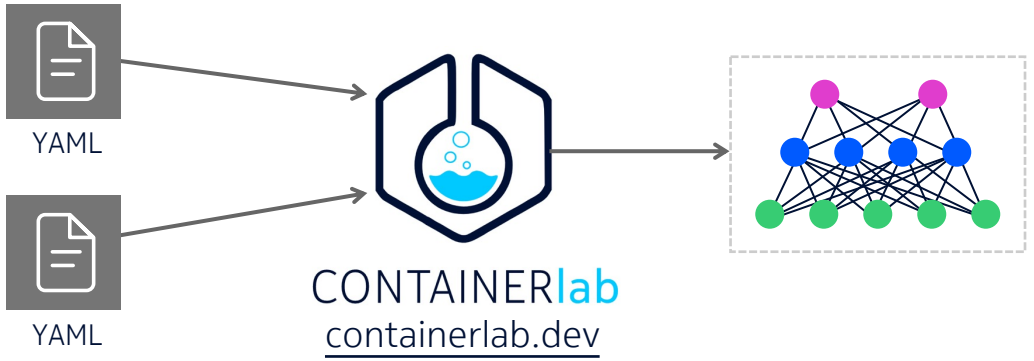
Just a single command

Other installation options:
https://containerlab.dev/install/

Topology file

Declarative way to define a lab

```
name: mylab

topology:
  nodes:
    [redacted] : [redacted]
    [redacted] : [redacted]

  links:
    - [redacted] : [redacted]
```



https://containerlab.dev

Building an IXP lab

Adding Nokia SR OS node

Topology definition

ixp.clab.yml

```yaml
name: ixp

topology:
  nodes:
    peer1:
      kind: vr-nokia_sros
      image: sros:23.3.R1
      license: license.key
```

Logical view

Building an IXP lab

Adding FRR node

Topology definition

ixp.clab.yml

```
name: ixp

topology:
  nodes:
    peer1: {…}

    peer2:
      kind: linux
      image: quay.io/frrouting/frr:8.4.1
```

Logical view

Building an IXP lab

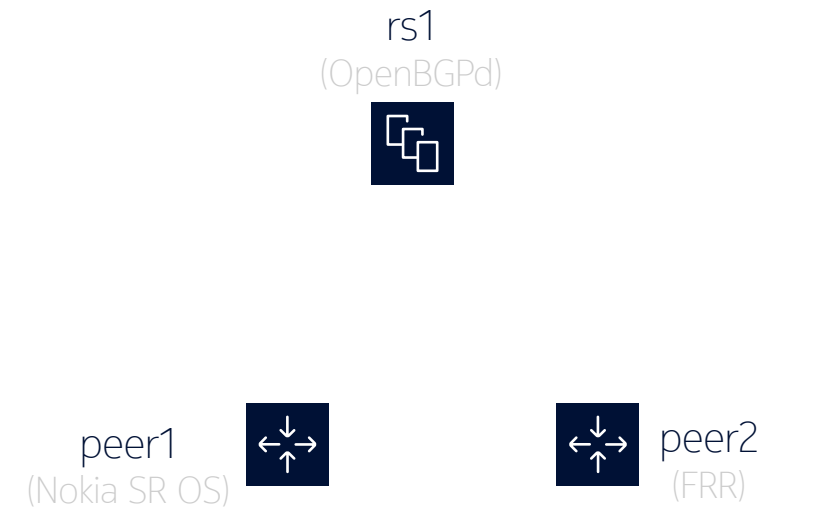
Adding route servers

Topology definition

ixp.clab.yml

```
name: ixp

topology:
  nodes:
    peer1: {…}
    peer2: {…}

    rs1:
      kind: linux
      image: quay.io/openbgpd/openbgpd:7.9
```

Logical view



Building an IXP lab

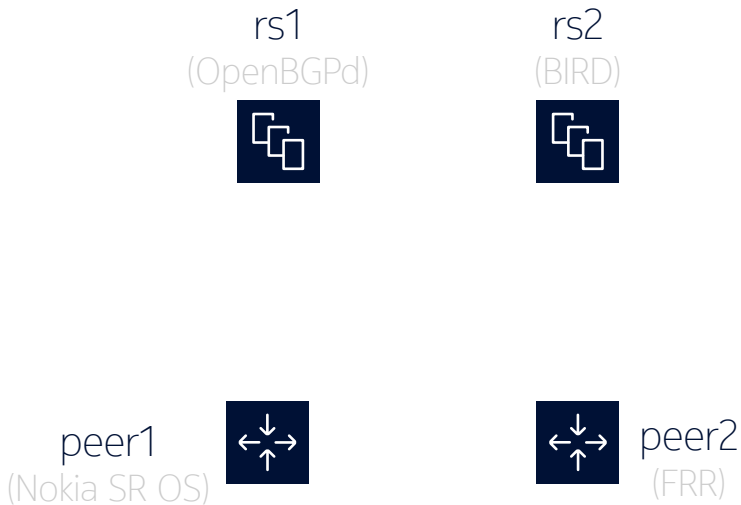
Adding route servers

Topology definition

ixp.clab.yml

```
name: ixp

topology:
  nodes:
    peer1: {…}
    peer2: {…}
    rs1:   {…}

    rs2:
      kind: linux
      image: ghcr.io/srl-labs/bird:2.0.11
```

Logical view



Building an IXP lab

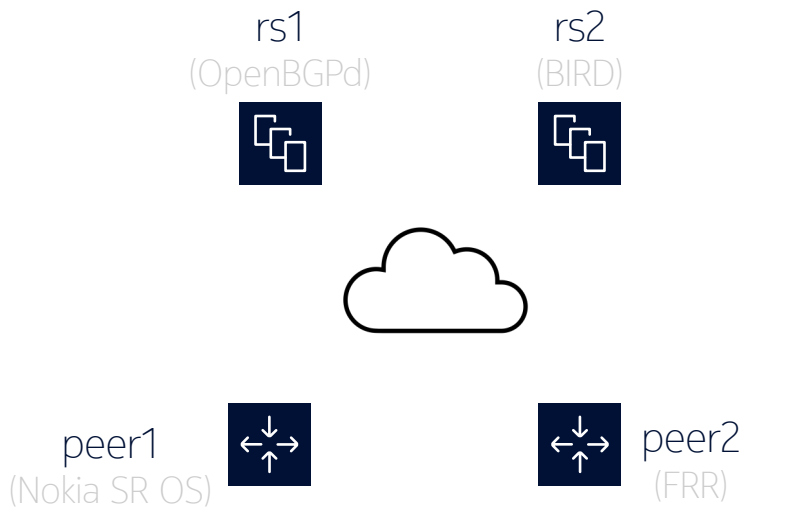
Adding peering LAN

Topology definition

ixp.clab.yml

```
name: ixp

topology:
  nodes:
    peer1:  {…}
    peer2:  {…}
    rs1:    {…}
    rs2:    {…}

    ixp-net:
      kind: bridge
```

Logical view



Building an IXP lab

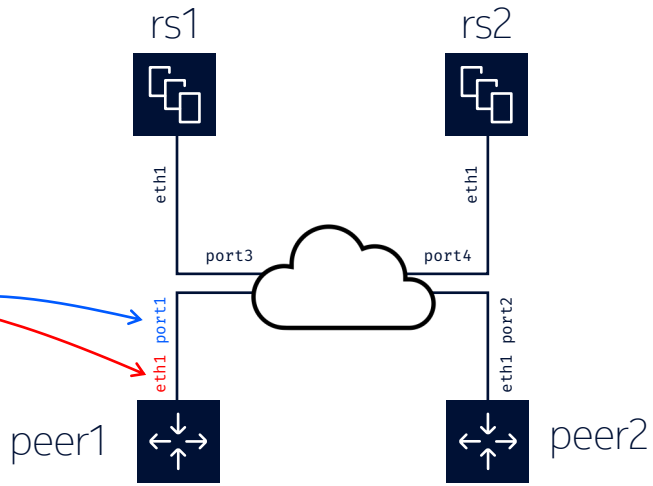
Adding links

Topology definition

ixp.clab.yml

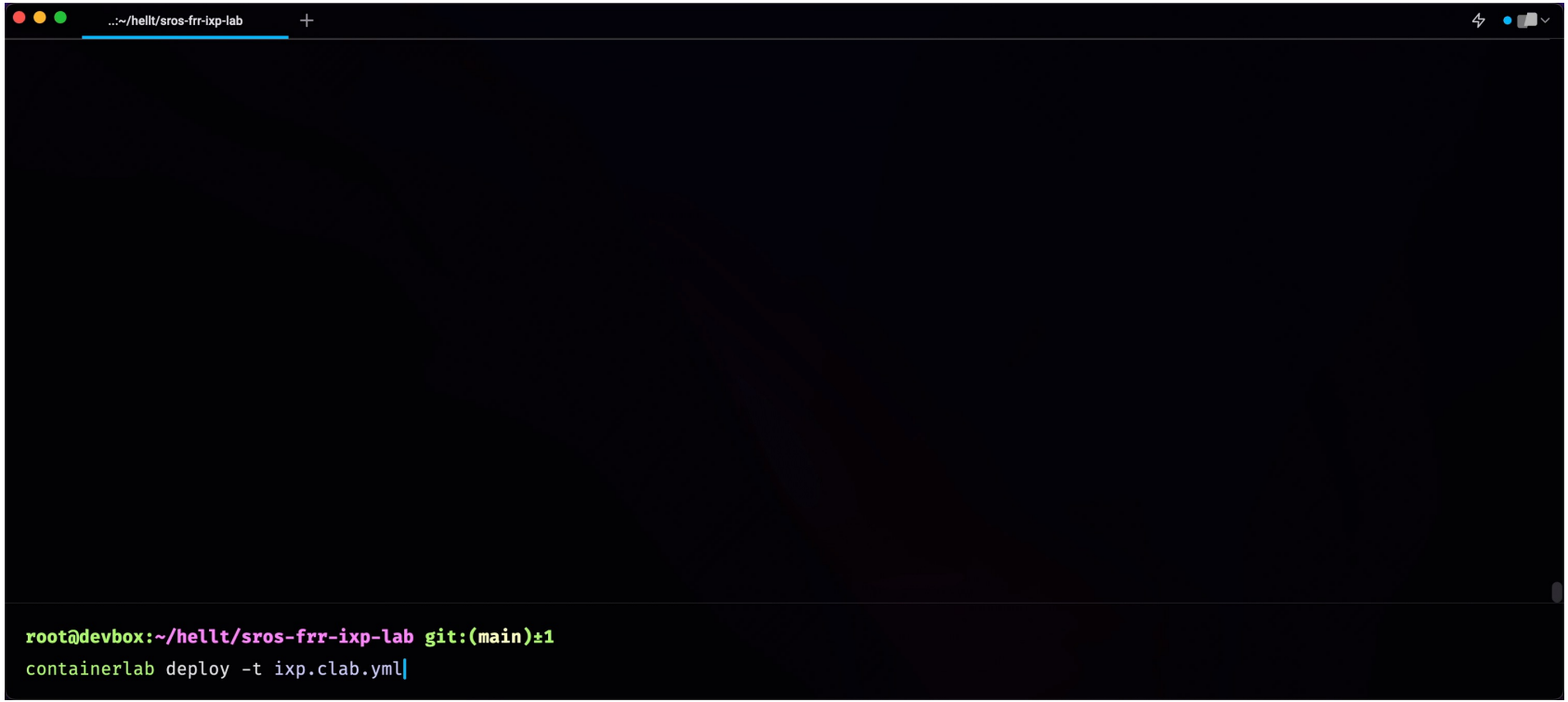
```
name: ixp

topology:
  nodes:
    peer1:    {…}
    peer2:    {…}
    rs1:      {…}
    rs2:      {…}
    ixp-net:  {…}

  links:
    - endpoints: ["peer1:eth1", "ixp-net:port1"]
    - endpoints: ["peer2:eth1", "ixp-net:port2"]
    - endpoints: ["rs1:eth1",   "ixp-net:port3"]
    - endpoints: ["rs2:eth1",   "ixp-net:port4"]
```

Logical view



*Management links are not shown

Deploying the lab



Deploying the lab

```
root@devbox:~/hellt/sros-frr-ixp-lab git:(main) (2.525s)
containerlab deploy -t ixp.clab.yml
INFO[0000] Containerlab v0.39.0 started
INFO[0000] Parsing & checking topology file: ixp.clab.yml
INFO[0000] Creating lab directory: /root/hellt/sros-frr-ixp-lab/clab-ixp
INFO[0000] Creating docker network: Name="clab", IPv4Subnet="172.20.20.0/24", IPv6Subnet="2001:172:20:20::/64", MTU="1450"
INFO[0000] Creating container: "rs2"
INFO[0000] Creating container: "rs1"
INFO[0000] Creating container: "peer2"
INFO[0000] Creating container: "peer1"
INFO[0001] Creating virtual wire: peer2:eth1 <--> ixp-net:port2
INFO[0001] Creating virtual wire: peer1:eth1 <--> ixp-net:port1
INFO[0001] Creating virtual wire: rs2:eth1 <--> ixp-net:port4
INFO[0001] Creating virtual wire: rs1:eth1 <--> ixp-net:port3
INFO[0002] Adding containerlab host entries to /etc/hosts file
+---+----------------+--------------+-------------------------------+--------------+---------+----------------+----------------------+
| # |      Name      | Container ID |             Image             |     Kind     |  State  |  IPv4 Address  |     IPv6 Address     |
+---+----------------+--------------+-------------------------------+--------------+---------+----------------+----------------------+
| 1 | clab-ixp-peer1 | 94f22546922e | sros:23.3.R1                  | vr-nokia_sros | running | 172.20.20.3/24 | 2001:172:20:20::3/64 |
| 2 | clab-ixp-peer2 | 8ba9c9bdbfce | quay.io/frrouting/frr:8.4.1   | linux         | running | 172.20.20.2/24 | 2001:172:20:20::2/64 |
| 3 | clab-ixp-rs1   | 0ac2e6518043 | quay.io/openbgpd/openbgpd:7.9 | linux         | running | 172.20.20.5/24 | 2001:172:20:20::5/64 |
| 4 | clab-ixp-rs2   | 37d7f3507b8b | ghcr.io/srl-labs/bird:2.0.11  | linux         | running | 172.20.20.4/24 | 2001:172:20:20::4/64 |
+---+----------------+--------------+-------------------------------+--------------+---------+----------------+----------------------+

root@devbox:~/hellt/sros-frr-ixp-lab git:(main)±1
```

Containerlab

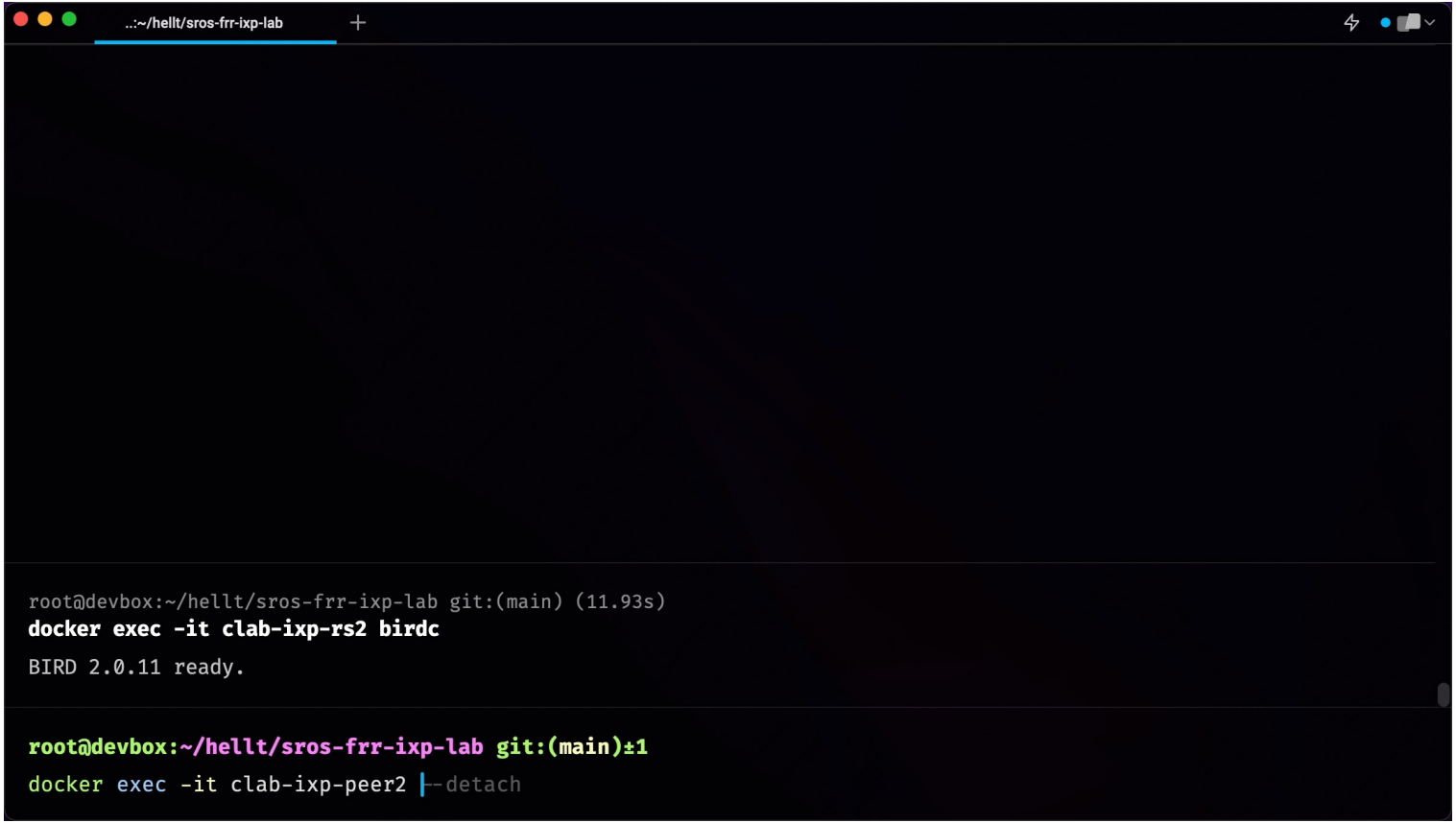
Connecting to the nodes

SSH

```
ssh admin@clab-ixp-peer1

admin@clab-ixp-peer1's password:

[/]
A:admin@peer1#
```

Docker exec

```
docker exec -it clab-ixp-rs2 birdc

BIRD 2.0.11 ready.
bird>
```



Building an IXP lab

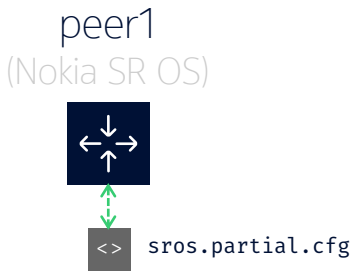
Adding startup configurations

Topology definition

ixp.clab.yml

```
name: ixp

topology:
  nodes:
    peer1:
      kind: vr-nokia_sros
      image: sros:23.3.R1
      license: license.key
      startup-config: sros.partial.cfg
```

Logical view



Building an IXP lab

Adding startup configurations

Topology definition

ixp.clab.yml

```yaml
name: ixp

topology:
  nodes:
    peer1: {…}

    peer2:
      binds:
        - frr.conf:/etc/frr/frr.conf
        - daemons:/etc/frr/daemons
```

Logical view

Building an IXP lab

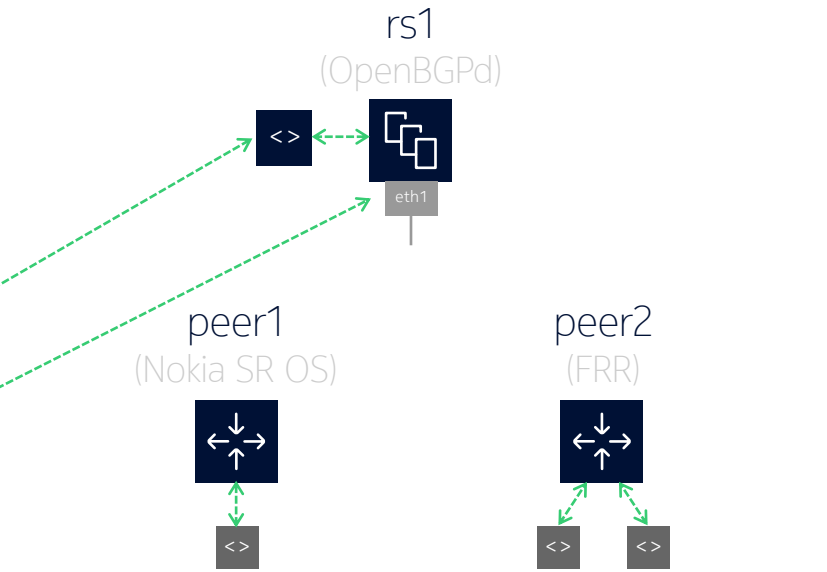
Adding startup configurations

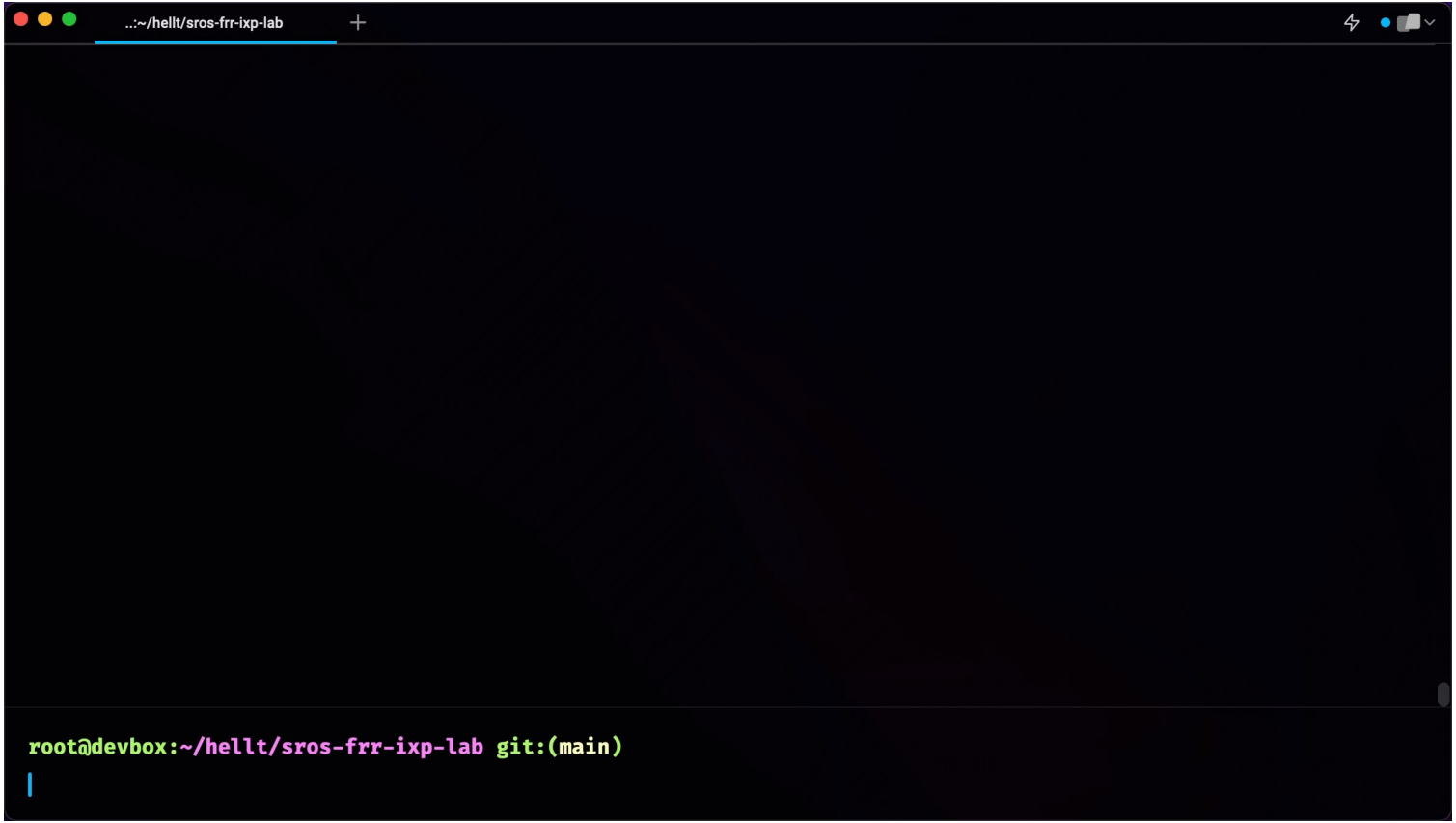
Topology definition

ixp.clab.yml

```
name: ixp

topology:
  nodes:
    peer1: {…}
    peer2: {…}

    rs1:
      binds:
        - openbgpd.conf:/etc/bgpd/bgpd.conf
      exec:
        - ip address add dev eth1 192.168.0.3/24
```

Logical view

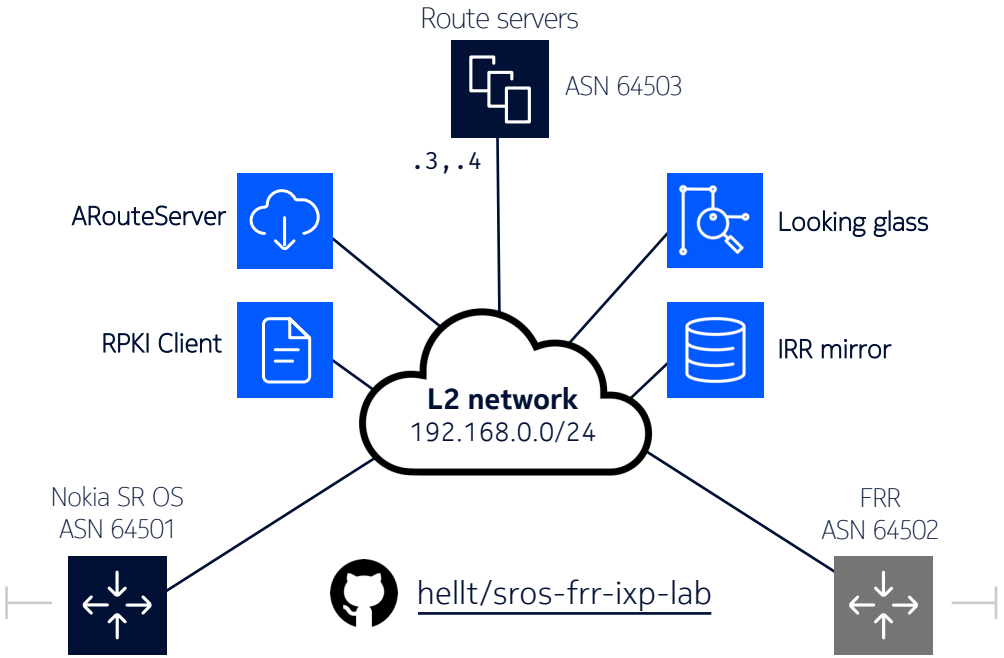




What next?

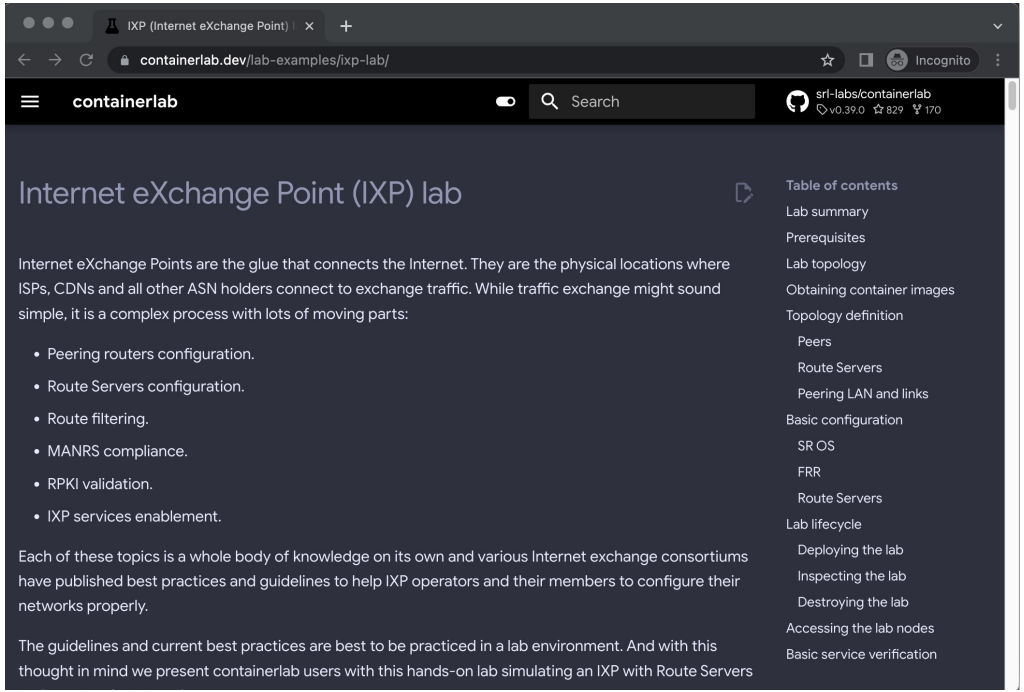
All IXP use cases

- ACL filtering
- MAC filtering
- BUM filtering
- RPKI validation
- MANRS conformance
- Route servers config (ARouteServer)
- Looking glass integration
- Vendor try-out



Lab

A to Z explanation



IXP-Lab

Supported systems

srl
vr-sros

crpd
vr-vmx
vr-vqfx

ceos
vr-veos

vr-xrv9k
vr-csr
vr-n9kv

sonic-vs
frr

cvx

vr-pan

vr-ftosv

keysight_ixia-c

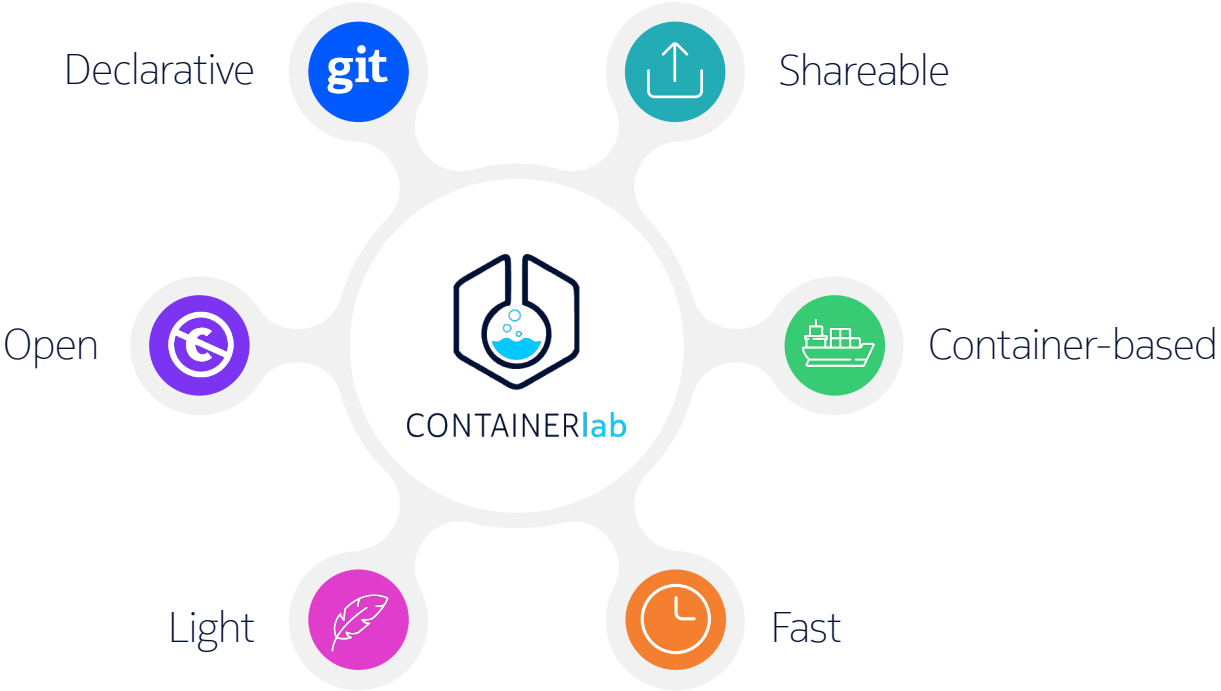
vr-ros

ipinfusion_ocnos

checkpoint_cloudgard

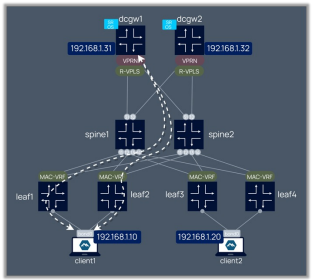
Containerlab

A different look at labs



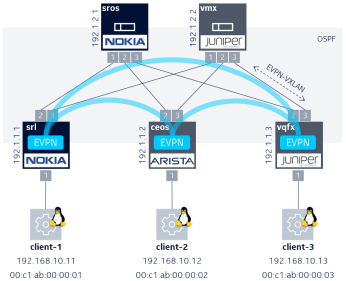
Labs We've Built For The Community

Nokia EVPN Interop



srl-labs/nokia-evpn-lab

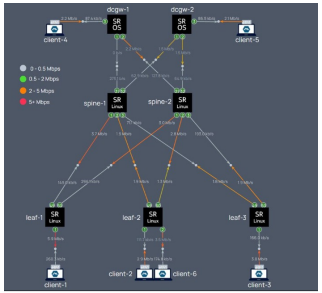
Multivendor EVPN



srl-labs/multivendor-evpn-lab

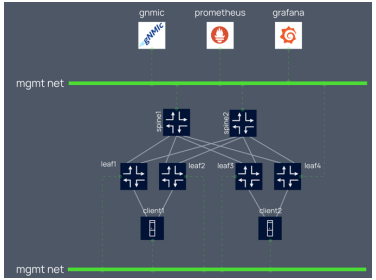
CONTAINERlab

SR Linux & SROS Telemetry



srl-labs/srl-sros-telemetry-lab

SR Linux Oper-Group



srl-labs/opergroup-lab

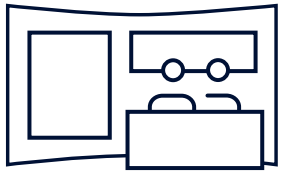
Containerlab

Get in touch

https://containerlab.dev

Discord server

srl-labs/containerlab

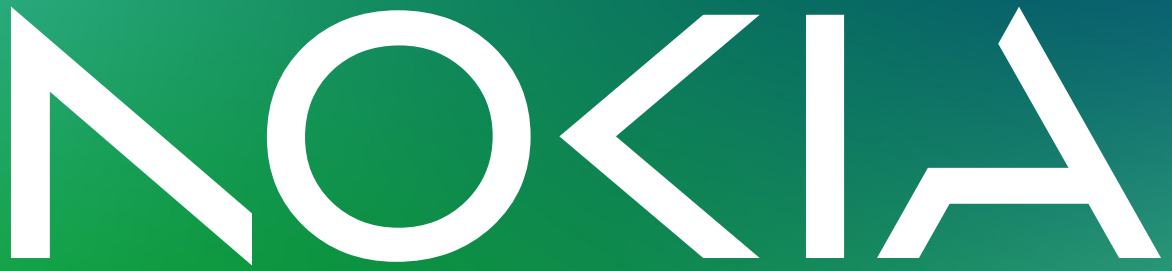


I am here today!

Invitation

Webinar

https://www.lacnic.net/7007/1/lacnic/


NOKIA