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ENERGY SCIENCES NETWORK

Building a Realistic Orchestration Validation Environment for netwoRks (ROVER)

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Office of Science

BERKELEY LAB

The ROVER Team

Team Members, from Left to Right:

Nick Buraglio, Chris Cummings, Luke Baker, Scott Richmond, George Robb, Dhivakaran (Dhiva) Muruganantham, Marc Koerner, Derek Howard, Sam Oehlert, Eric Smith, Garrett Stewart, Brendan White (Not pictured)

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The Problem

- Testing of orchestration software before deploying to production in a full featured environment is difficult, but required for full awareness
- Lab with physical elements is *very* constrained for resources (too many people, not enough equipment)
- Physical equipment lab (qLAB) configuration and orientation does not resemble production
- qLAB may be in a state of transition from one project to the next
- Resetting qLAB to a known state is currently not easily accomplished

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ROVER: Origins

- "Wow, it would be nice to do automated tests on our full orchestration stack!"
- Tested various platforms such as Eve-NG, found them not well suited for consistent but ephemeral topologies *with associated services****
- Learned about containerlab by talking to Roman Dodin (creator)
- Internal development and orchestration teams acknowledged need for this tooling, brought Planning and Architecture Group (PAG) into project
- PAG brought in to build an overall plan and to take ROVER from concept to initial release

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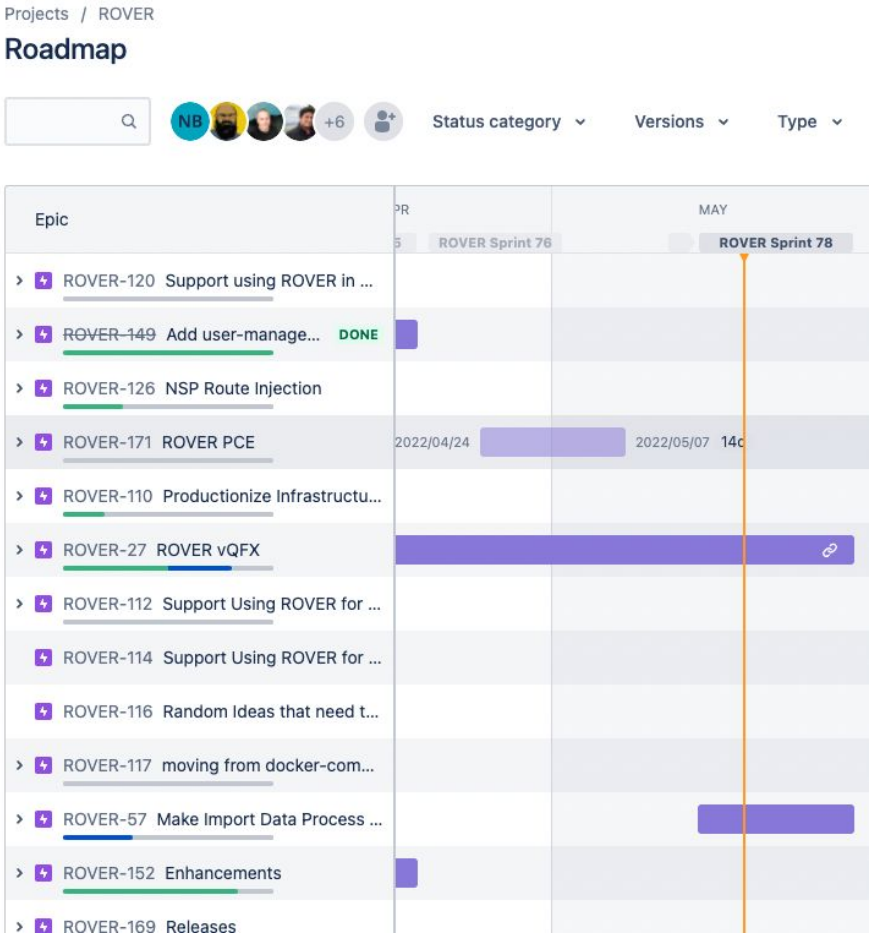
ROVER: Origins

- Structured like a software project
- Clear and achievable deliverables
- Driven by needs and requirements gathered beforehand
- **No scope creep**



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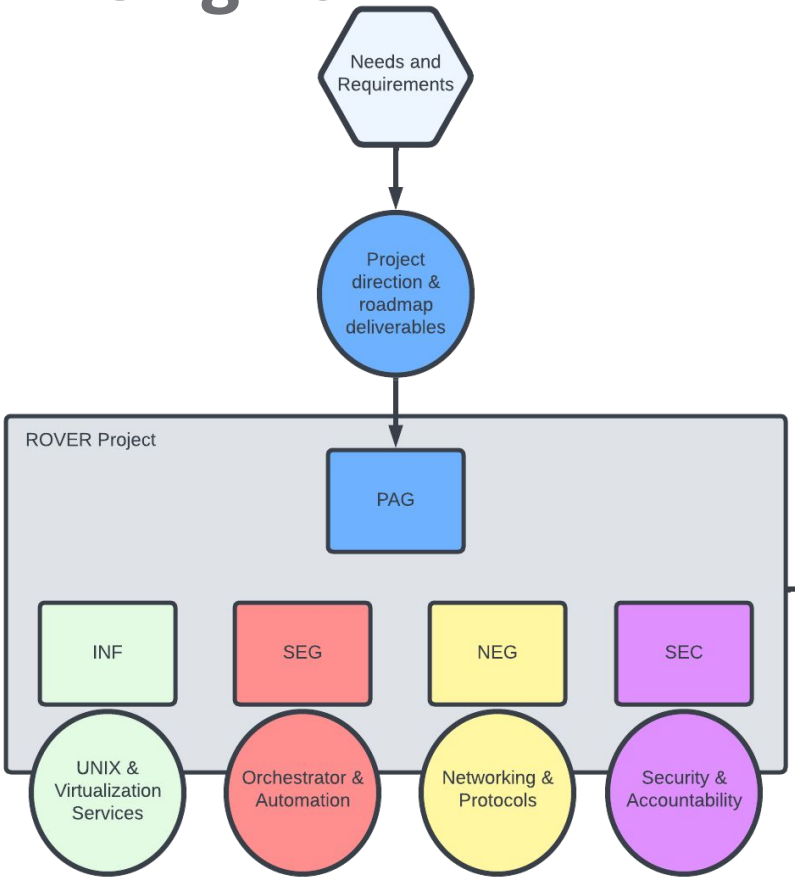
ROVER: Origins



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Deliverables

- Develop a repeatable, supportable test env for VRF migrations
- MUST—A Network topology based off production configs
- MUST—Contain OCD software to run orchestrated workflows
- MUST—Support for swapping out versions of OCD software to test latest changes
- Stretch Goals—Support dataplane capabilities
    a. Ping across links
    b. BGP, IS-IS, etc.

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Categories of Users

- 👨‍💻 Software Developers
- 👩‍💻 Network Engineers
- 👩‍🏫 Trainers demonstrating our orchestration tooling
- 👨‍🎓 Users of OCD software who need to learn the tools
- 💻 CI/CD Pipelines

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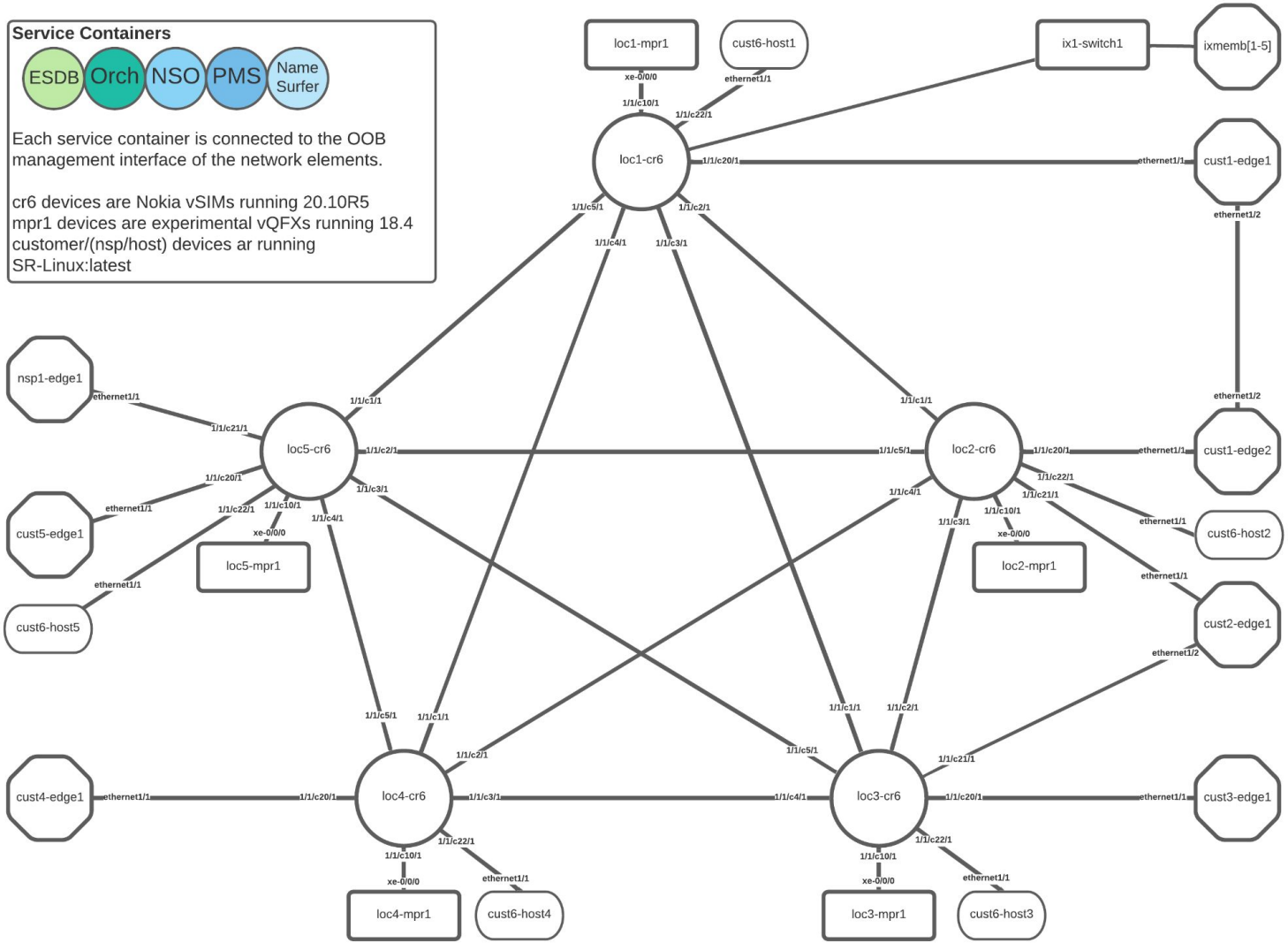
Topology

Service Containers

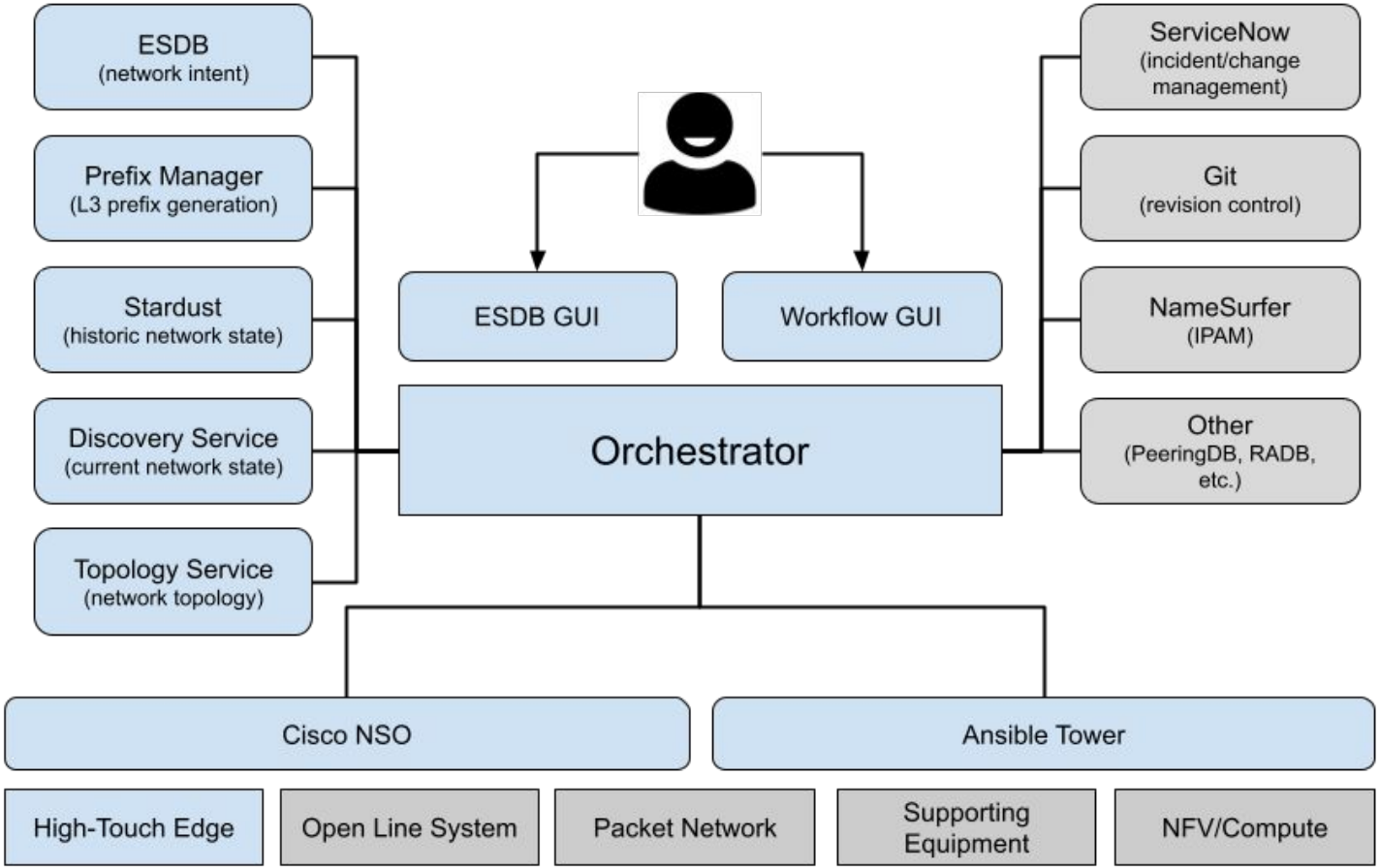
ESDB Orch NSO PMS Name Surfer

Each service container is connected to the OOB management interface of the network elements.

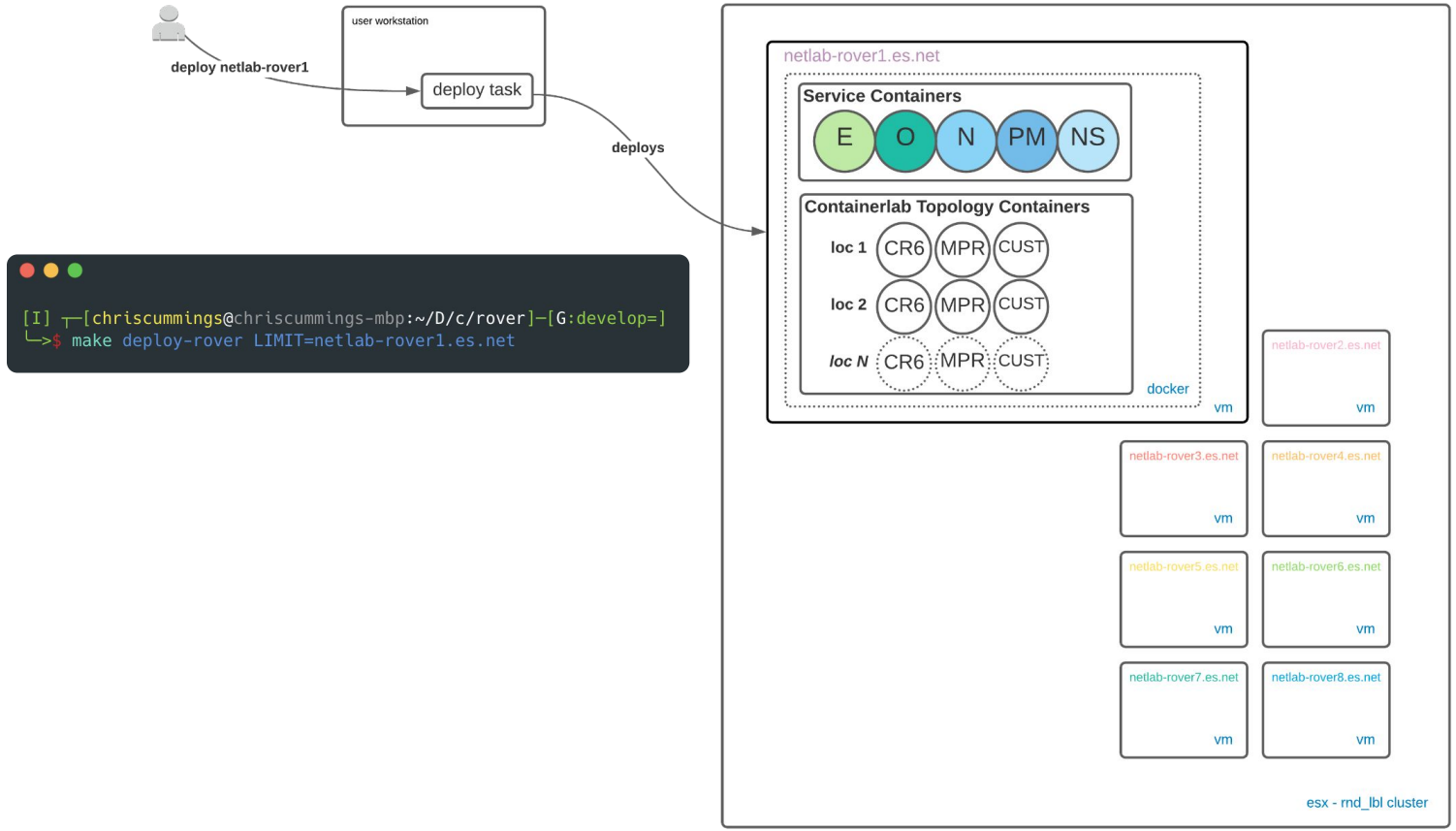
cr6 devices are Nokia vSIMs running 20.10R5
mpr1 devices are experimental vQFXs running 18.4
customer/(nsp/host) devices ar running SR-Linux:latest



ESnet6 Provisioning Stack



Deployment


Legend
ESDB
Orchestrator
NSO
Prefix-Manager
NameSurfer
user workstation
deploy netlab-rover1
deploy task
deploys
[I] ┌─[chriscummings@chriscummings-mbp:~/D/c/rover]─[G:develop=]
└─>$ make deploy-rover LIMIT=netlab-rover1.es.net
netlab-rover1.es.net
Service Containers
E
O
N
PM
NS
Containerlab Topology Containers
loc 1
CR6
MPR
CUST
loc 2
CR6
MPR
CUST
loc N
CR6
MPR
CUST
docker
vm
netlab-rover2.es.net
vm
netlab-rover3.es.net
vm
netlab-rover4.es.net
vm
netlab-rover5.es.net
vm
netlab-rover6.es.net
vm
netlab-rover7.es.net
vm
netlab-rover8.es.net
vm
esx - rnd_lbl cluster

Demonstration

- Walkthrough of a Backbone Link Deployment Workflow
- Walkthrough of BGP Peer Deployment Workflow

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Questions?

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