Orchestrated Service Provisioning in the GÉANT Global Platform for Labs

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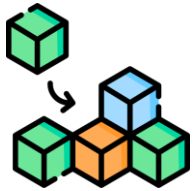
Introduction

- **Growing demand for flexibility and programmability** across the R&E community to support a diverse range of experimental use cases.
- **Rising network complexity** makes coordinating even simple configuration changes across heterogeneous, multi-domain infrastructures increasingly difficult.
- **Orchestration and automation** are thus becoming essential for achieving scalable, reliable, and flexible network service management in the future.
- Network orchestration and automation encompasses methodologies and software tools to automate the **deployment and configuration of network equipment and services**, replacing repetitive, cost-inefficient, and error-prone manual operations with an Infrastructure as Code approach.

Contributions

The Global Platform for Labs (GP4L) offers a large-scale experimental network infrastructure dedicated to experimentation, innovation, and collaboration in advanced network technologies. GP4L both **benefits from our work and is used to validate it**.

Design and develop workflows that automate the management of resources and the configuration of experiments over the infrastructure of the GP4L experimental testbed.



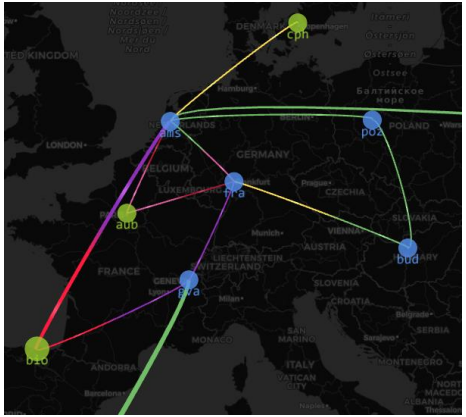
Contribute towards providing **modular and reusable solutions and tools for network automation and orchestration** that can be easily adopted, adapted, and extended by NRENs and organizations.

The GÉANT Global Platform for Labs

Around 50 total networking and computing devices distributed over 19 partners

Programmable network infrastructure with support of up to 400GE ports

RARE P4 / DPDK / XDP Dataplane
FreeRtr Control Plane



Unique playground to validate emerging orchestration practices in a setting that mirrors the complexity of real-world production networks.

Thus, the goal is not only to enable efficient **provisioning and lifecycle management of services in GP4L**, but also to produce **reusable workflows that can be** adapted by other R&E networks.

Components of our Solution

Network Source of Truth (NSoT)

Maat

Device configuration

ANSIBLE

LSO Lightweight Service Orchestrator

Jinja

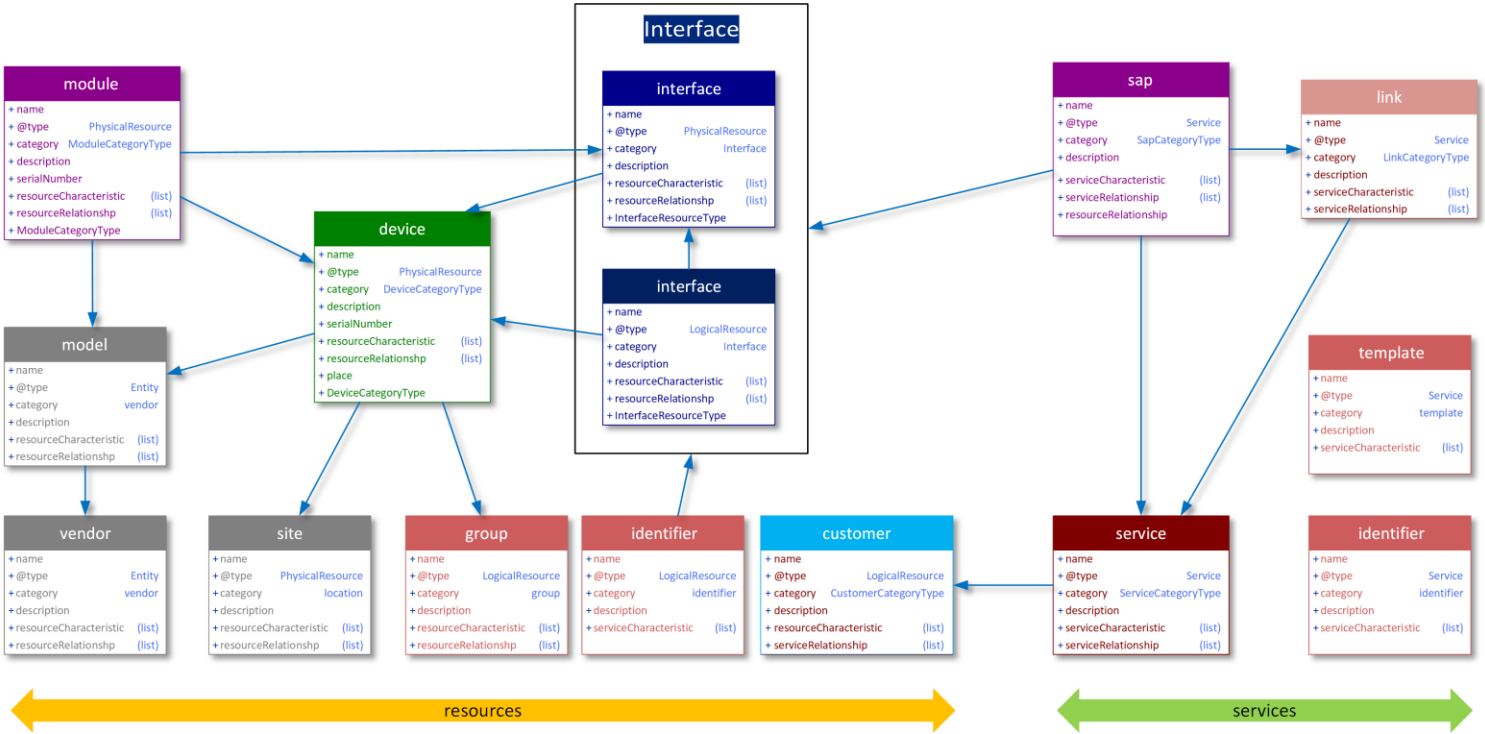
Workflow Engine

Apache Airflow

GP4L Digital Twin

CONTAINERlab

Data Model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+ category ModuleCategoryType
+ description
+ serialNumber
+ resourceCharacteristic (list)
+ resourceRelationshp (list)
+ ModuleCategoryType
interface
+ name
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+ description
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+ InterfaceResourceType
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+ description
+ serviceCharacteristic (list)
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+ resourceRelationship
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+ place
+ DeviceCategoryType
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+ description
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vendor
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+ description
+ resourceCharacteristic (list)
+ resourceRelationshp (list)
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+ category group
+ description
+ resourceCharacteristic (list)
+ resourceRelationshp (list)
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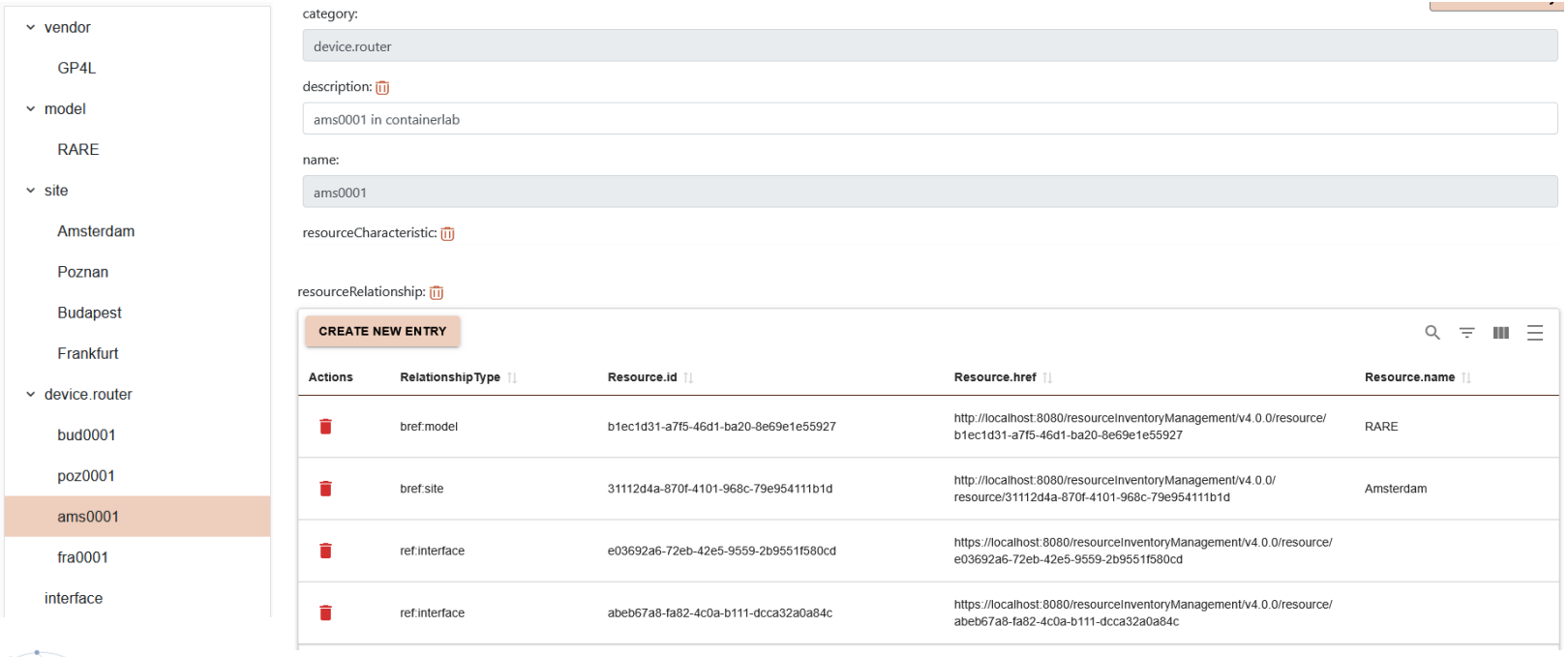
+ description
+ serviceCharacteristic (list)
resources
services

Data Model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GP4L
model
RARE
site
Amsterdam
Poznan
Budapest
Frankfurt
device.router
bud0001
poz0001
ams0001
fra0001
interface
category:
device.router
description:
ams0001 in containerlab
name:
ams0001
resourceCharacteristic:
resourceRelationship:
CREATE NEW ENTRY
Actions
RelationshipType
Resource.id
Resource.href
Resource.name
bref:model
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RARE
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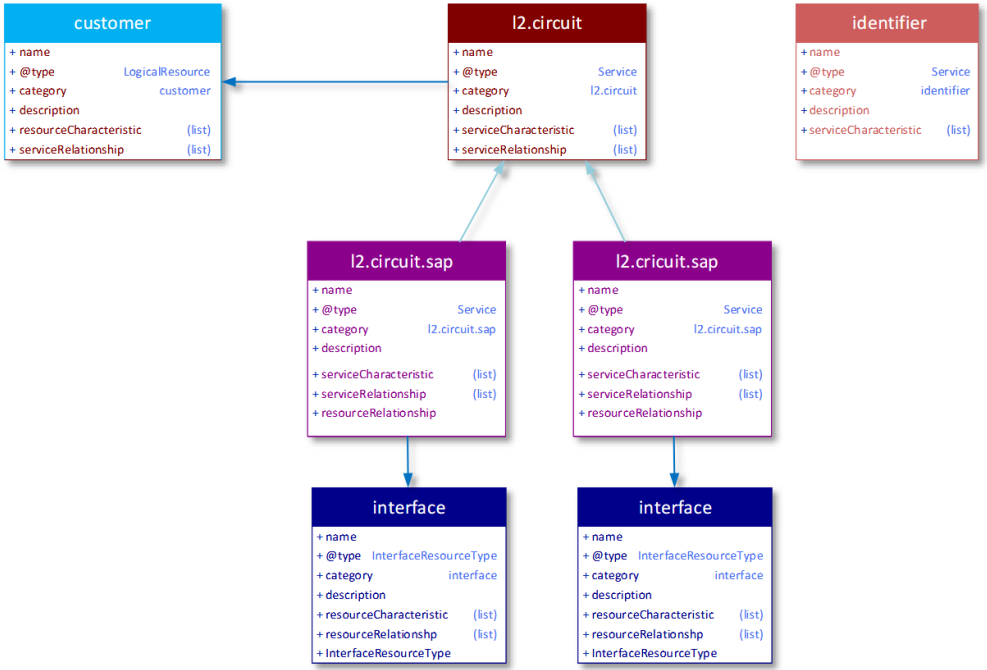
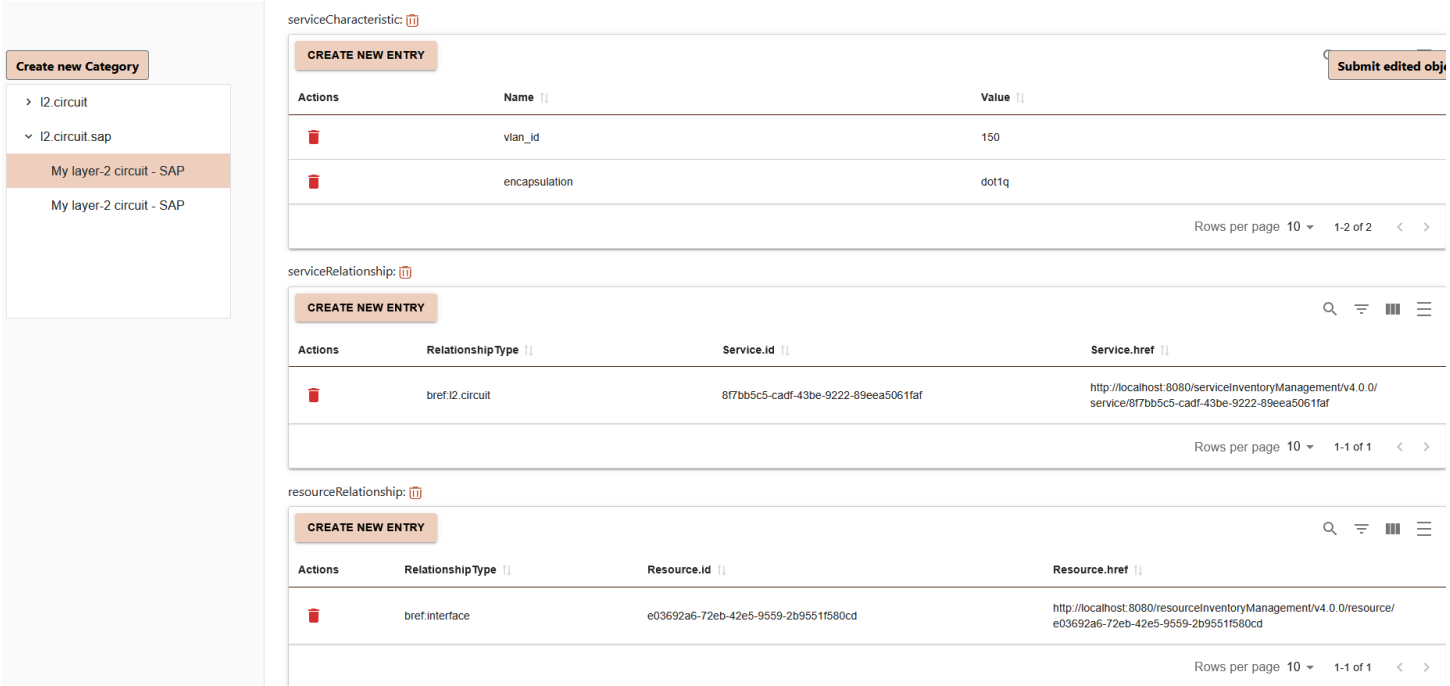
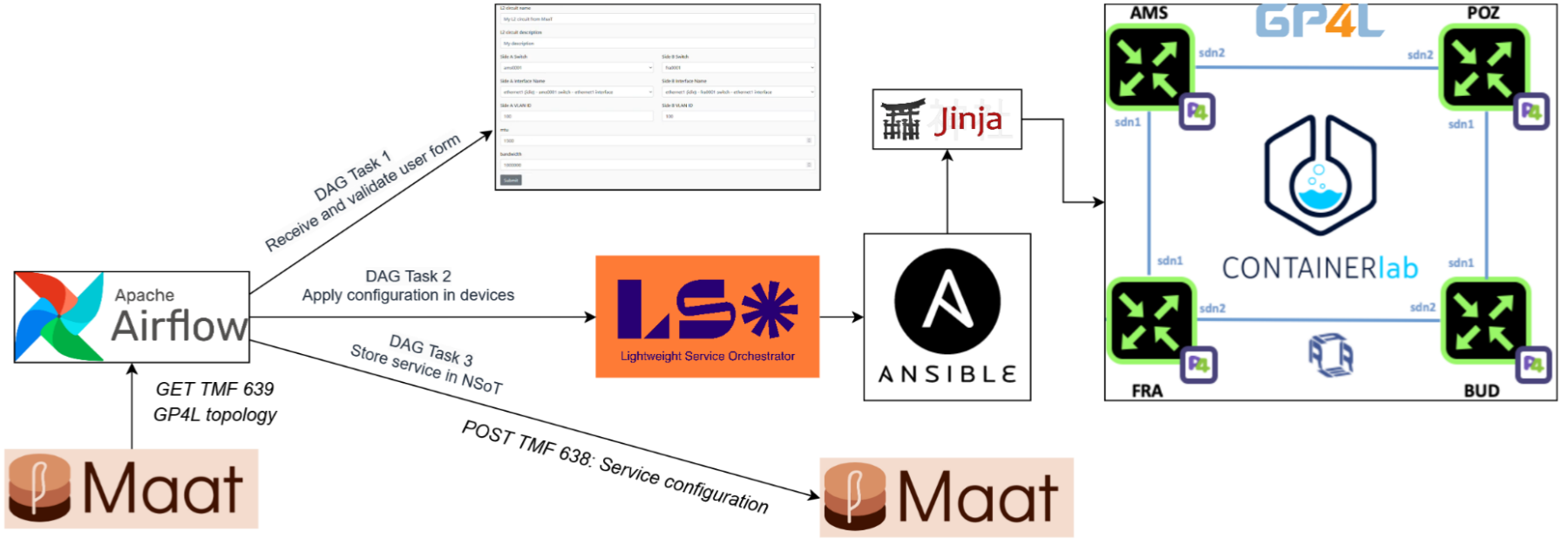
Data Model – Layer-2 Circuit Service



Data Model – Layer-2 Circuit Service



Service Provisioning Workflow



Conclusions

- Ongoing work towards orchestrated service provisioning that focuses on **modularity, flexibility, and reusability.**
- It is being validated in GP4L through this work, but it is also being developed in parallel in the production PIONIER (Polish NREN) network.
    - Thus, the reusability and adaptability is being validated in **two types of scenarios: experimental, and production.**
- Planned future work includes adding new service types (e.g. L2 EVPN), enhancing lifecycle support, exploring other emerging technologies in the field of network automation, and overall refining the solution based on feedback.

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¡Gracias por su atención!

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