



Orchestrating Smooth Operations

The case of GP4L

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Agenda

- The Global Platform for Lab (GP4L)
- Automation and Orchestration in GP4L
 - Components
 - Pilot & Use Cases
 - Future work

The Global Platform for Lab (GP4L)



01

GP4L Experimental Testbed

A P4 distributed infrastructure that can be used by researchers to run network experiments.

GP4L Digital Transformation Use Cases

Network automation and orchestration solutions that will drive the digital transformation efforts.

02

03

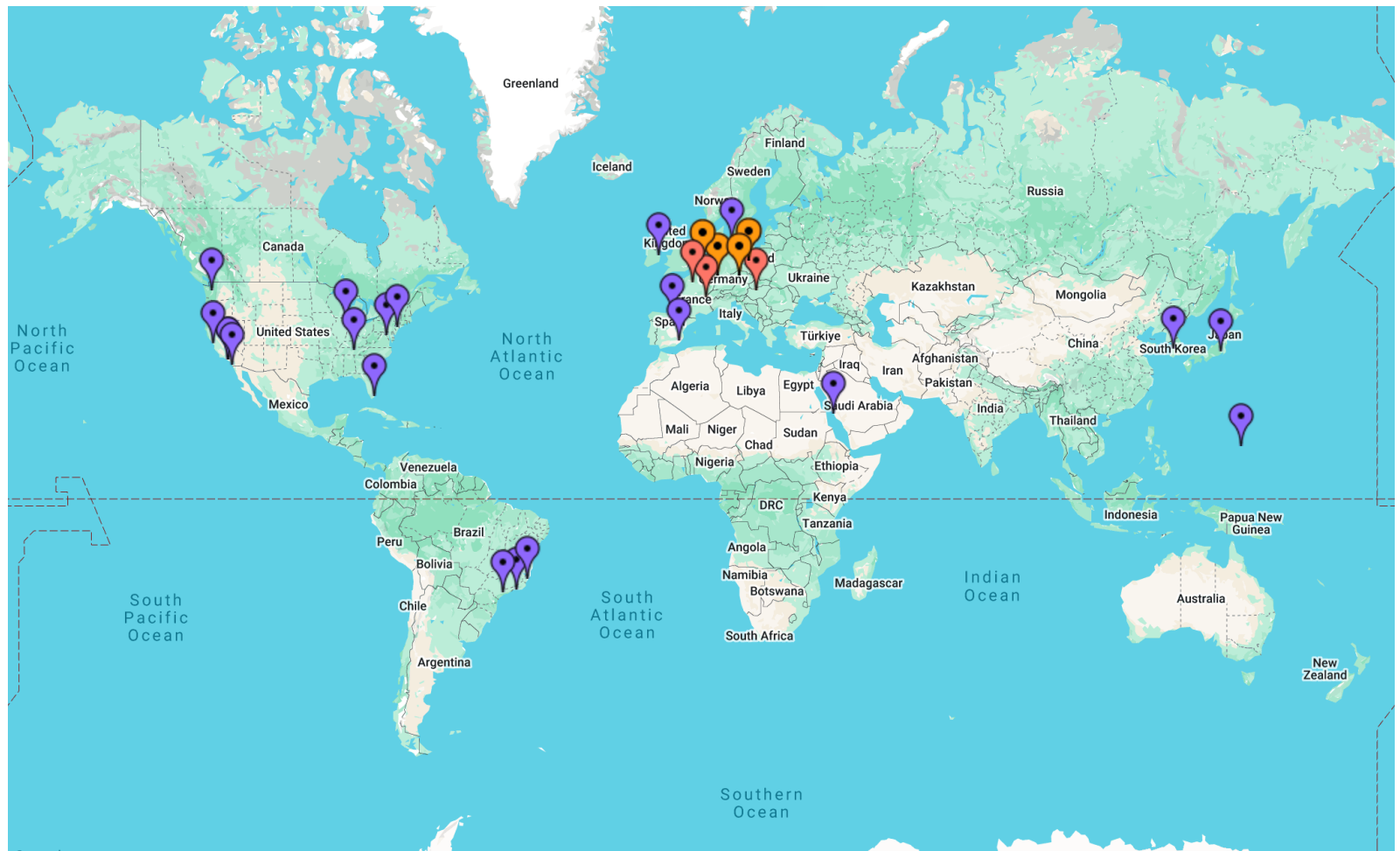
GP4L Community Collaboration

Open for discussion and collaboration on digital transformation pilots:

- Service Provisioning Pilot for PIONIER

GP4L Experimental Testbed

A programmable network infrastructure that can be used to run cutting-edge network experiments.



id	Institution	Country	id	Institution	Country
1	GÉANT	NL	23	TT	US
2	GÉANT	DE	24	KISTI	KR
3	GÉANT	HU	25	KAUST	UAE
4	GÉANT	PL	26	KDDI	JP
5	MC36	HU	27	GÉANT	CH
6	RENATER	FR	28	GÉANT	CH
7	SWITCH	CH	29	GÉANT	CH
8	STARLIGHT	US	30	GÉANT	CH
9	TCD	IR	31	UM	ES
10	GÉANT	FR	32	UPB	ES
11	RNP	BR	33	UPB	ES
12	GÉANT	CZ	34	KDDI	JP
13	CERN	CH	35	UMA	NL
14	CALTECH	US	36	SDSC	US
15	AM-Light	US	37	UG	US
16	RNP	BR	38	NYSERNet	US
17	UFES	BR	39	PW	US
18	HEANET	IR	40	FIU	US
19	UM	US	41	TU	DK
20	CALTECH	US	42	CENIC-LA	US
21	CALTECH	US	43	CENIC-SV	US
22	CALTECH	US	44	CENIC-SI	US

GP4L towards Digital Transformation

Orchestrated and automated operations

- Source of Truth
 - Workflows
 - Components
 - APIs
 - GitOps
- ...

Principles

- Define intent
- Model orchestration
 - Integrate tools
 - Automate all
- Verify in pre-production



Digital Twin

virtual copy of the network



Education

Courses in Network Automation eAcademy



Network Visualization
Graphics as code



Use Cases & Solutions

Generalized, modular workflows and code

Cloud-based

All implementations are available in **NMaas** 

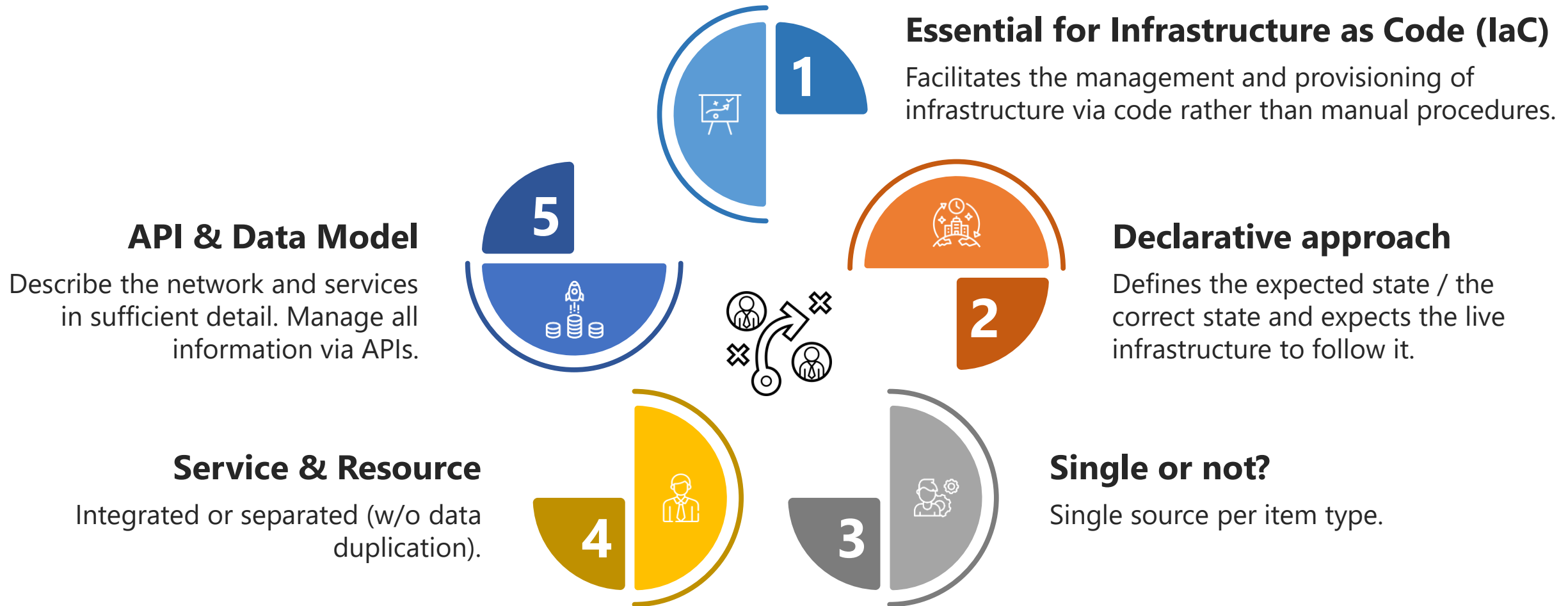
Reusable

Open-source code and documentation

GP4L Playground



Want to automate? First decide on the Source of Truth (SoT)



The Case of GP4L

NetBox
The SoT for GP4L network resources.



Maat
The SoT for GP4L network services

Maat as SoT

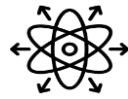


Maat is a microservice for open digital platforms that serves as a single source of truth for physical and logical resources and/or services.



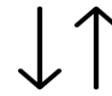
Open Standard-based APIs

- Full CRUD support for IaC out of the box
- TMF638 Service management REST API
- TMF639 Resource management REST API



Extensible Data Model

- JSON-based data model
- Validation based on data model schema file
- Extensions do not require changes in code or database
- Multiple data models can be defined in custom schemas



Events Hub

- External applications can register and listen to selected events
- Events are archived for historical purposes
- TMF standard API

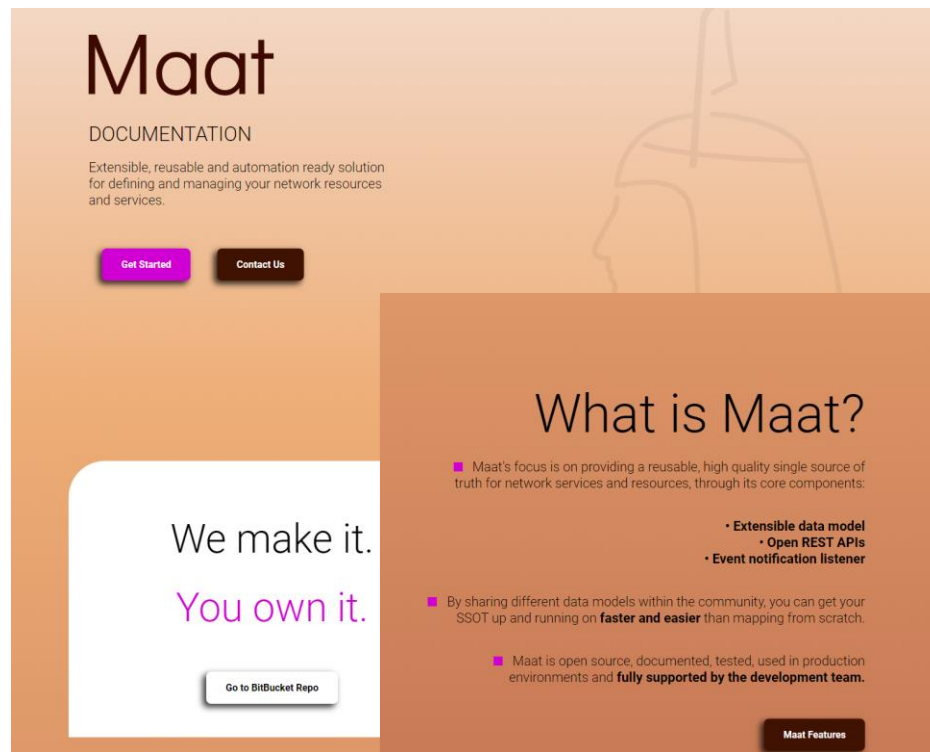


Technology stack

- NoSQL database (MongoDB)
- Spring Boot 3 library
- Docker
- Keycloak
- OAuthN 2.0

Maat as SoT

<https://geant-netdev.gitlab-pages.pcss.pl/MaatDocs/>



Maat

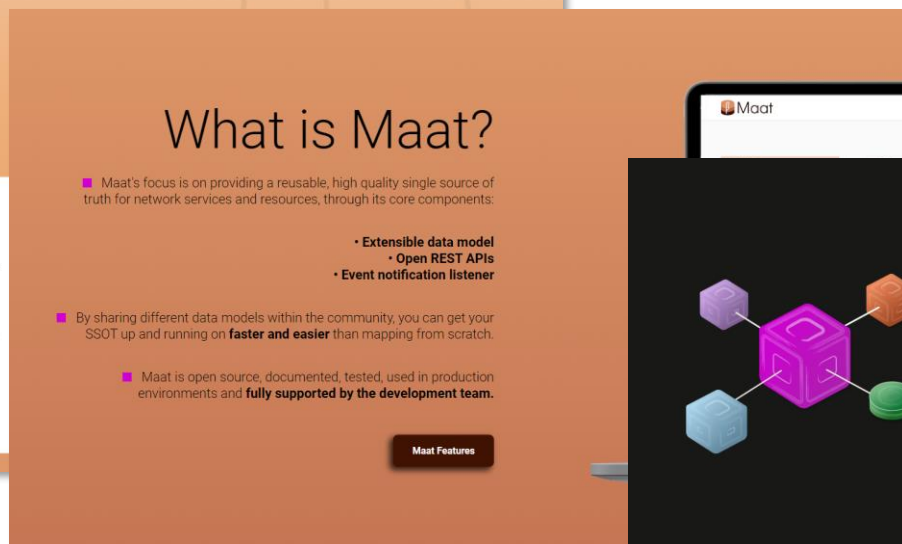
DOCUMENTATION

Extensible, reusable and automation ready solution for defining and managing your network resources and services.

[Get Started](#) [Contact Us](#)

We make it.
You own it.

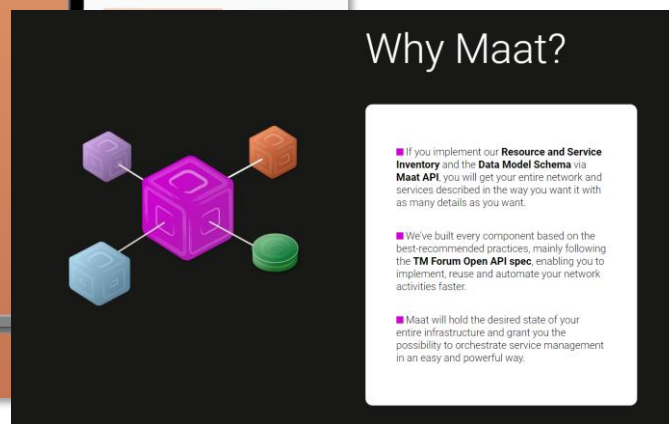
[Go to BitBucket Repo](#)



What is Maat?

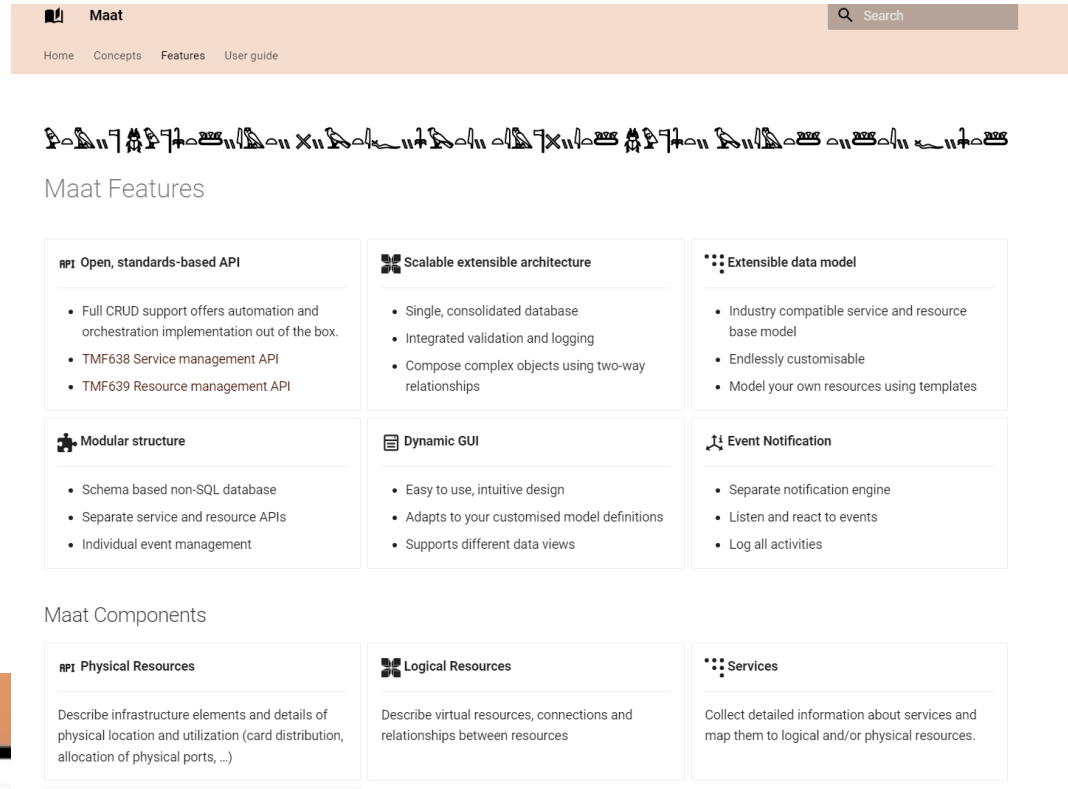
- Maat's focus is on providing a reusable, high quality single source of truth for network services and resources, through its core components:
 - Extensible data model
 - Open REST APIs
 - Event notification listener
- By sharing different data models within the community, you can get your SSOT up and running on **faster and easier** than mapping from scratch.
- Maat is open source, documented, tested, used in production environments and **fully supported by the development team.**

[Maat Features](#)



Why Maat?

- If you implement our **Resource and Service Inventory** and the **Data Model Schema** via **Maat API**, you will get your entire network and services described in the way you want it, with as many details as you want.
- We've built every component based on the best-recommended practices, mainly following the **TM Forum Open API spec**, enabling you to implement, reuse and automate your network activities faster.
- Maat will hold the desired state of your entire infrastructure and grant you the possibility to orchestrate service management in an easy and powerful way.



Maat Search

Home Concepts Features User guide

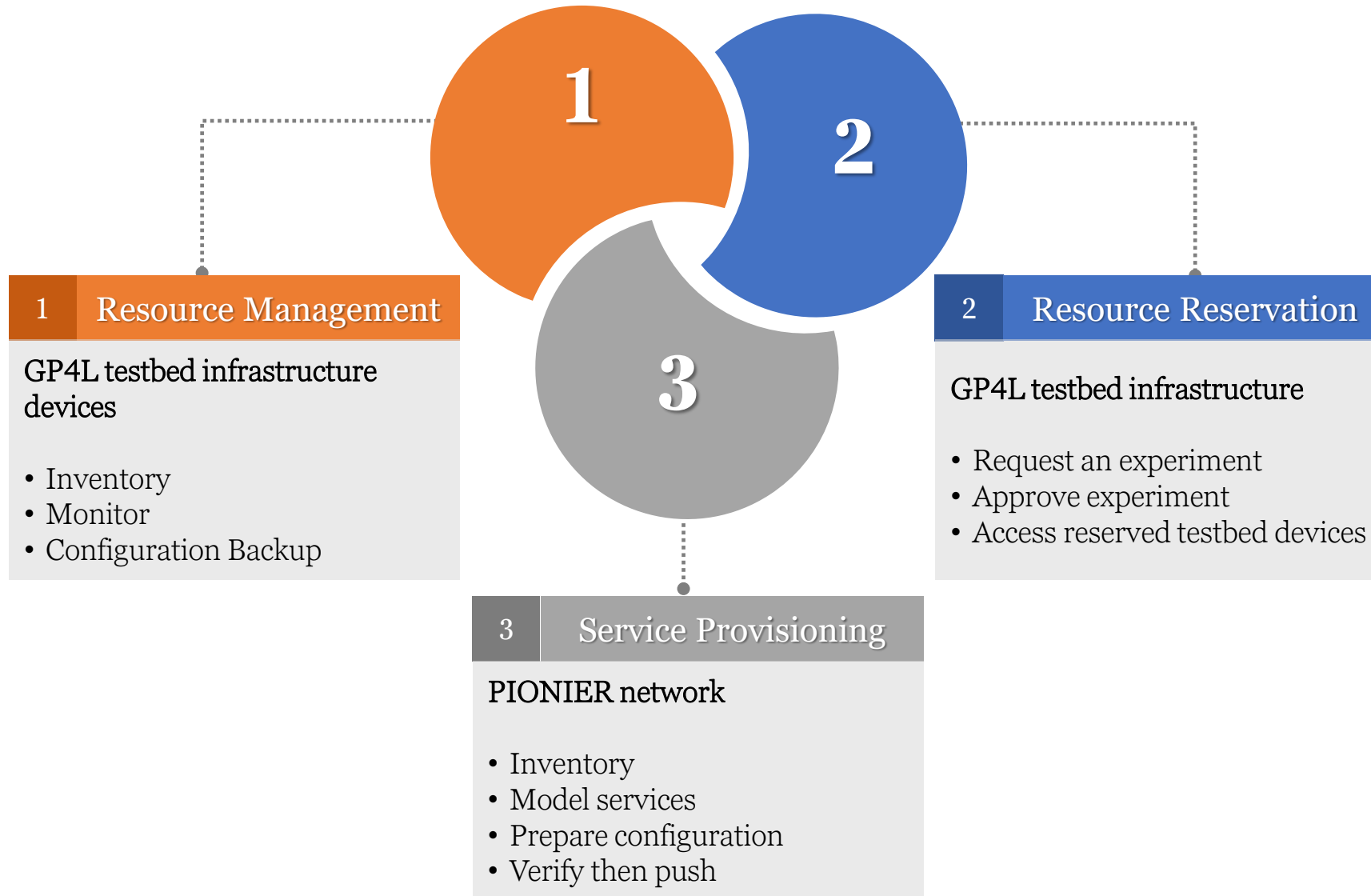
Maat Features

- API Open, standards-based API**
 - Full CRUD support offers automation and orchestration implementation out of the box.
 - TMF638 Service management API
 - TMF639 Resource management API
- Scalable extensible architecture**
 - Single, consolidated database
 - Integrated validation and logging
 - Compose complex objects using two-way relationships
- Extensible data model**
 - Industry compatible service and resource base model
 - Endlessly customisable
 - Model your own resources using templates
- Modular structure**
 - Schema based non-SQL database
 - Separate service and resource APIs
 - Individual event management
- Dynamic GUI**
 - Easy to use, intuitive design
 - Adapts to your customised model definitions
 - Supports different data views
- Event Notification**
 - Separate notification engine
 - Listen and react to events
 - Log all activities

Maat Components

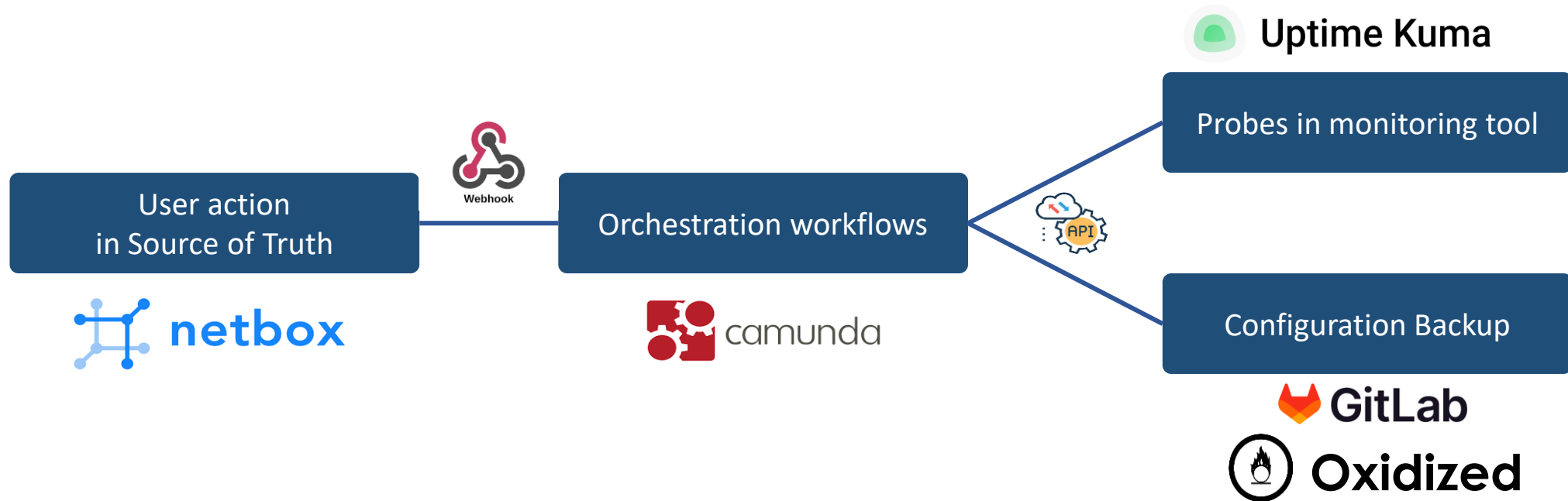
- Physical Resources**
Describe infrastructure elements and details of physical location and utilization (card distribution, allocation of physical ports, ...)
- Logical Resources**
Describe virtual resources, connections and relationships between resources
- Services**
Collect detailed information about services and map them to logical and/or physical resources.

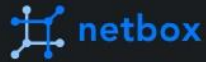
GP4L Automated Network Operations



Resource management use case

A GP4L partner connects a new programmable switch to the GP4L infrastructure.





Search



Devices

+ Add Import Export

Results 5 Filters

Quick search

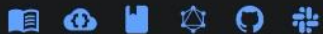
Configure Table

Name	Status	Tenant	Site	Location	Rack	Role	Manufacturer	Type	IP Address	
GP4L-AMS-01	Active	—	GEANT	—	—	router	siemens	234	172.16.26.151/24	
GP4L-PAR-01	Active	—	GEANT	—	—	router	siemens	234	—	
GP4L-PAR-02	Active	—	GEANT	—	—	router	siemens	234	192.168.122.126/24	
GP4L-POZ-01	Active	—	GEANT	—	—	router	siemens	234	172.16.26.154/24	
GP4L-POZ-02	Active	—	GEANT	—	—	router	siemens	234	172.16.26.152/24	

Per Page

Showing 1-5 of 5

+ Add Components Edit Selected Rename Delete Selected



Uptime Kuma

New Update

Status Pages

Dashboard



+ Add New Monitor

Search...

- 100% GP4L-AMS-01[1] [Progress bar]
- 100% GP4L-PAR-02[3] [Progress bar]
- 100% GP4L-POZ-01[4] [Progress bar]
- 100% GP4L-POZ-02[5] [Progress bar]

GP4L-POZ-01[4]

Ping: 172.16.26.154

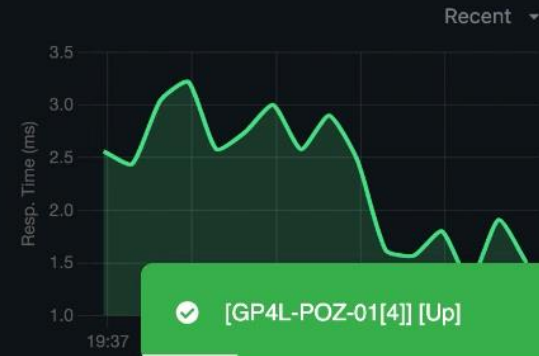
Pause Edit Clone Delete



Up

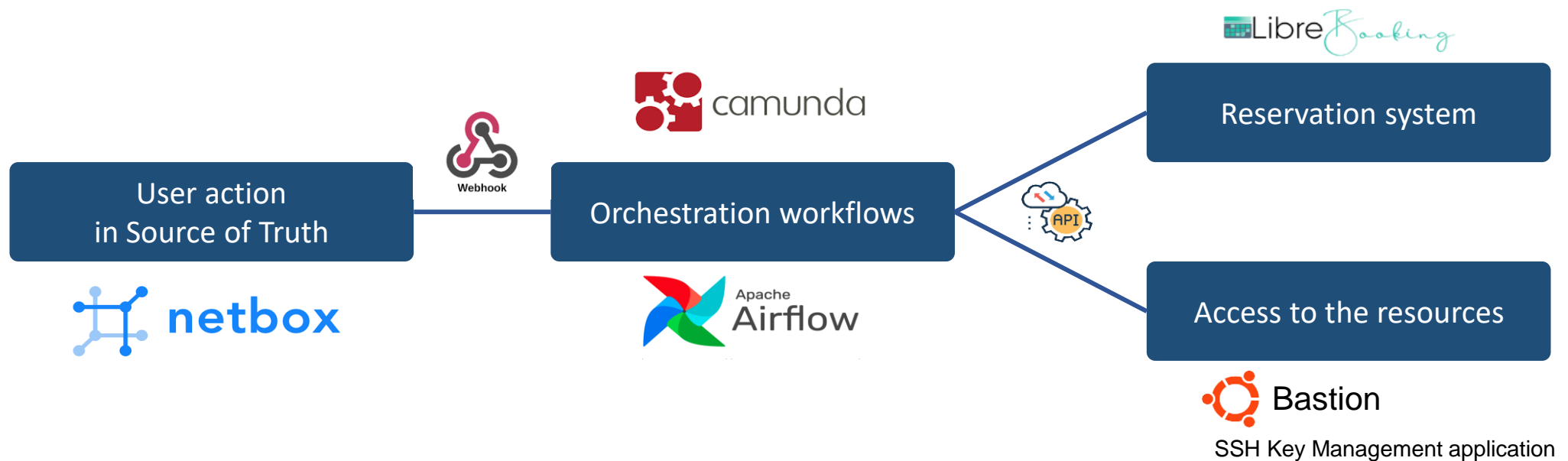
Check every 60 seconds

Ping (Current)	Avg. Ping (24-hour)	Uptime (24-hour)	Uptime (30-day)
1.5 ms	2 ms	100%	100%

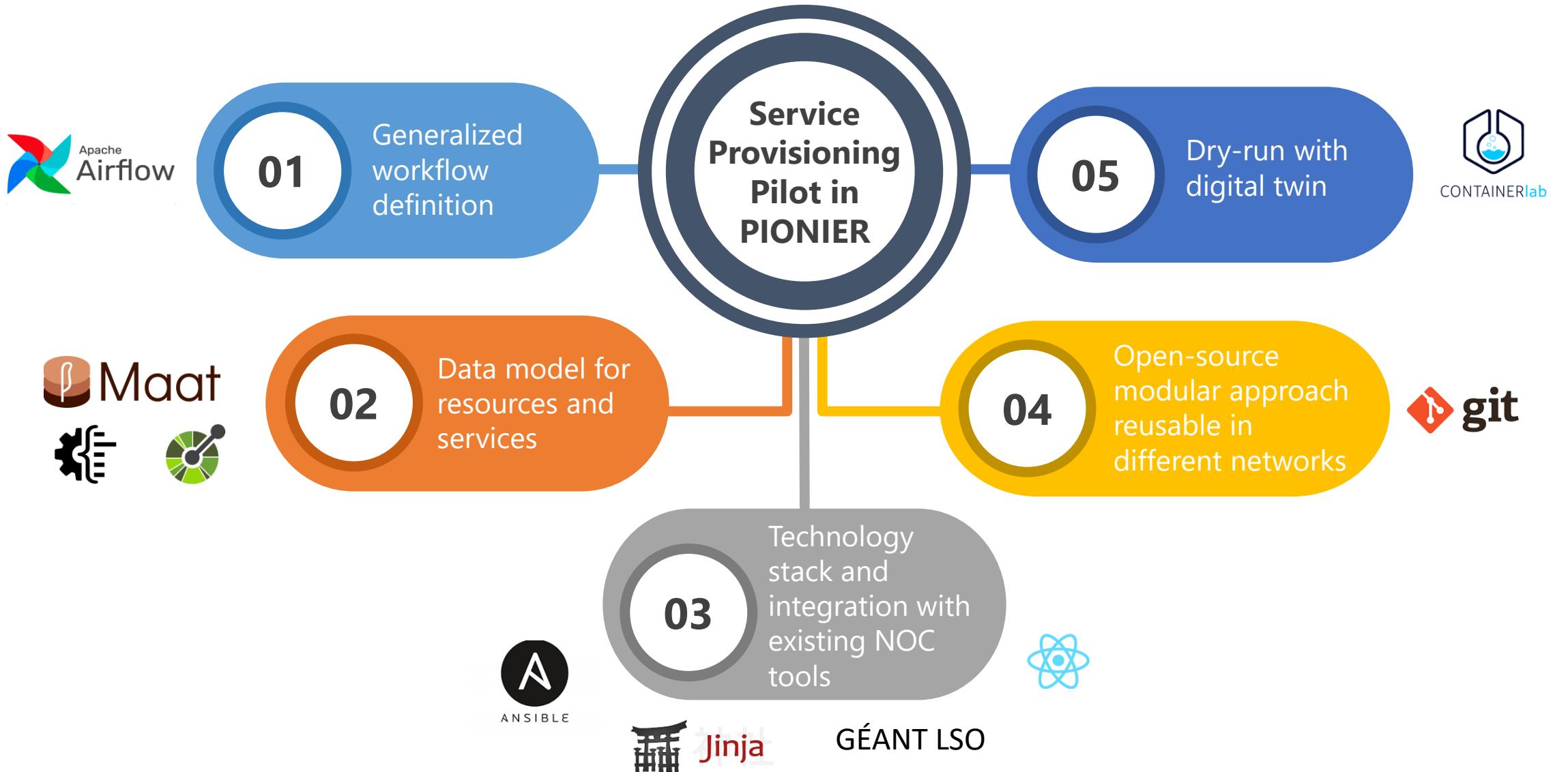


Experiment reservation use case

A researcher schedules an experiment in the GP4L testbed infrastructure.



GP4L Joint Collaboration

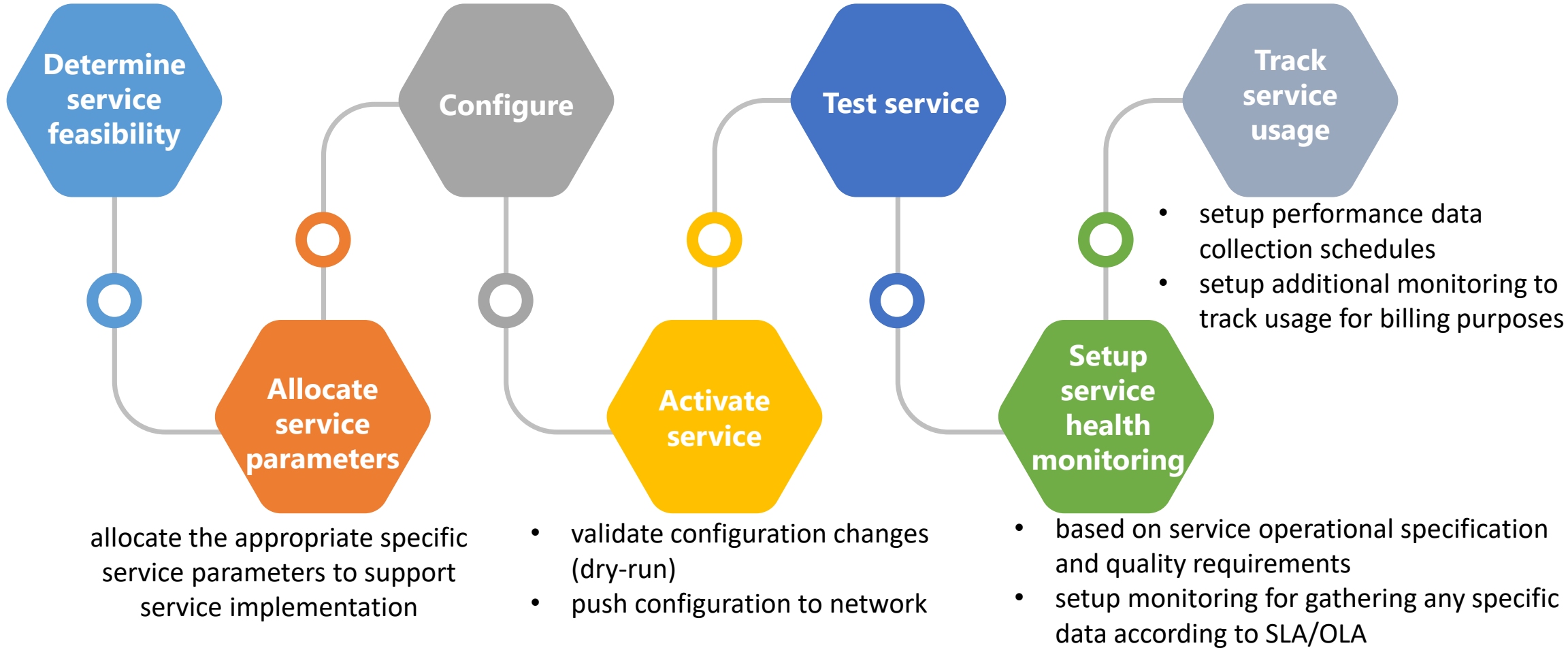


Service Provisioning Workflow

- check technical requirements for service provisioning
- reserve service parameters

prepare configuration for network devices

- run test and analyse results
- ensure all components are operating
- validate against intent



Lessons Learned

Constant Headaches

- Incomplete documentation
 - Libraries status
 - Bugs

Data Integrity

- Matching data across components



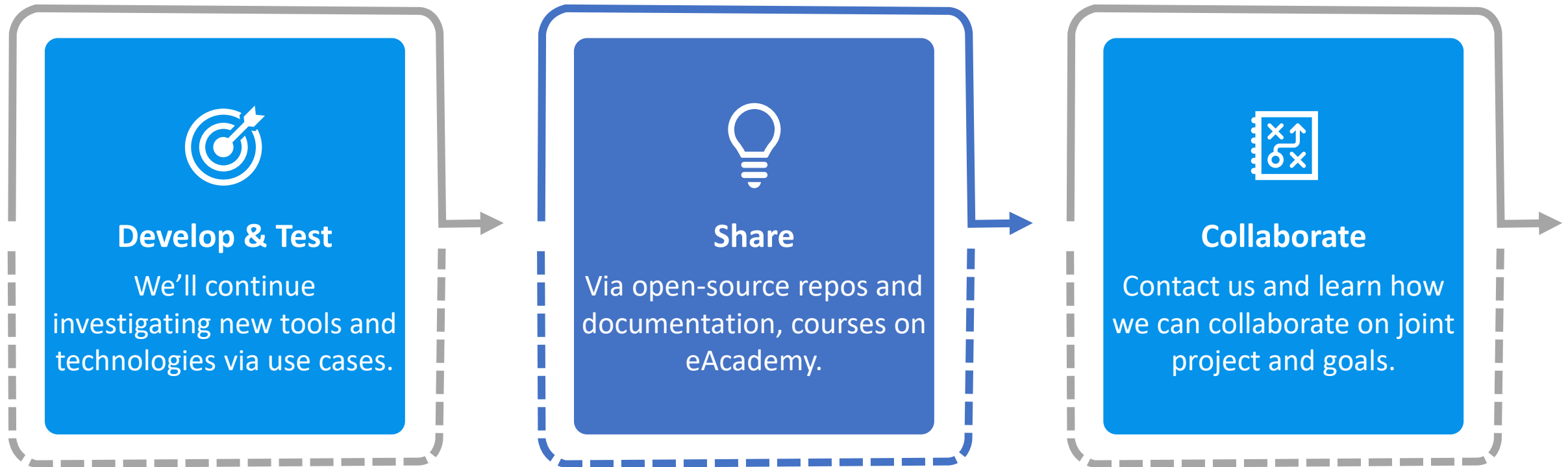
Workflow Flexibility

- Adding functionality
- Changing components

Compatibility

- The impact of upgrades

GP4L on the road of automation & orchestration...





Thank You

Contact: gp4l-admin@lists.geant.org

Demo video:

<https://www.youtube.com/watch?v=KYqpLPBDR3k>

Some of the slides in this presentation were designed by www.slideegg.com

www.geant.org



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