



GP4L in GÉANT-5 project

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Agenda

- Few words about GÉANT-5
- Global P4 Lab
 - Current footprint
 - Nodes & links composition
 - NMaaS as monitoring system
- 2 types of GP4L usage
 - Network experimentation
 - Tools conceptions “around” the network
- Automation & Orchestration
- Final words



[TL;DR] GÉANT-5 in a nutshell

GÉANT-5 in a nutshell



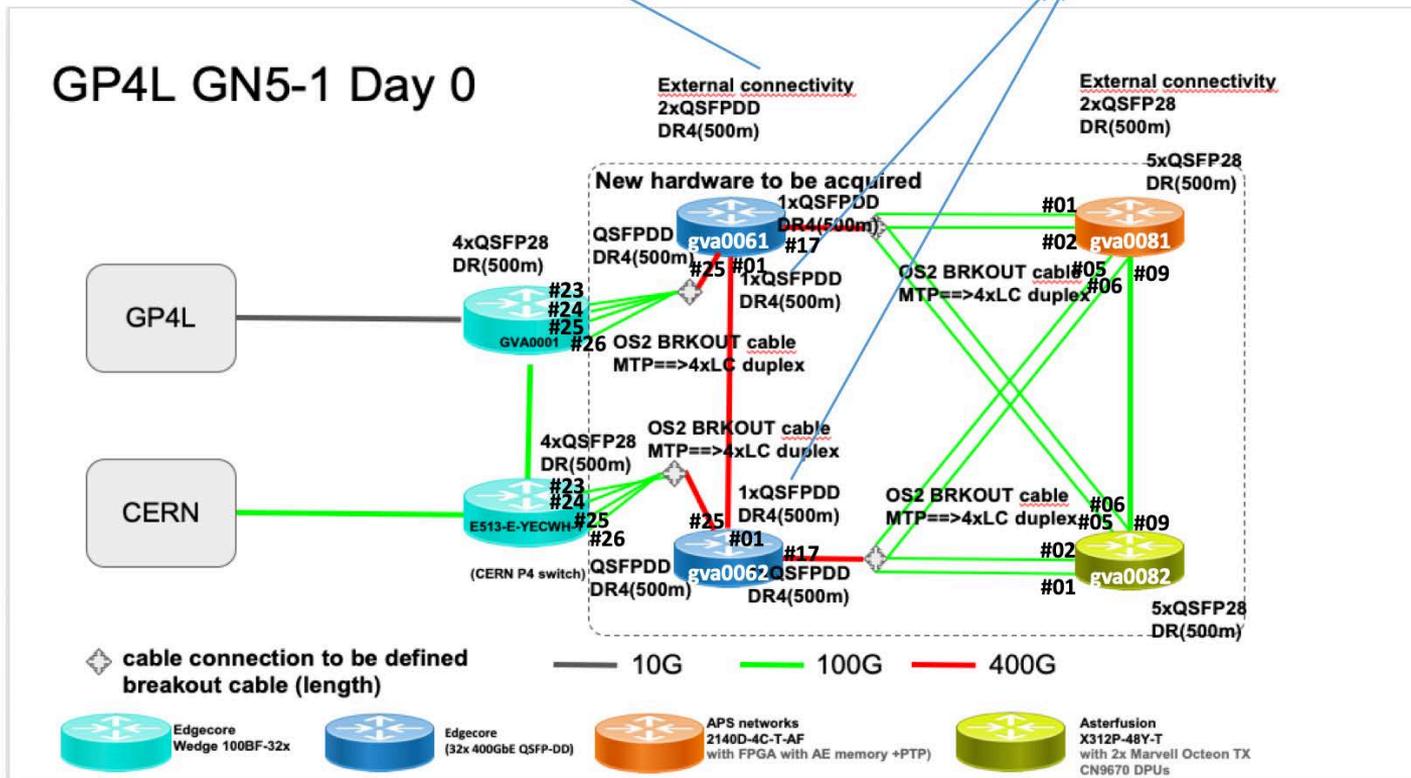
- GÉANT-5 is under **Horizon Europe**
 - « Research and innovation funding programme until 2027 »
- GÉANT-5 encompasses 43 countries
 - is in 1st iteration → **GN5-1** till end of 2024
- GN5-1 is divided into:
 - **Work packages** that in turns are divided into **Tasks**
 - Tasks can include inter-related **subtask**
 - **Global P4 Lab** is included in WP6-T2 (aka. platform)

Global P4 Lab. aka “GP4L” in GN5-1

Global P4 lab: “Persistent Programmable testbed” current footprint [2023/09]



Global P4 lab: Extension at Geneva



Global P4 lab: Node types

Available now in GP4L !



3.2/6.4 Tbps



12.8 Tbps

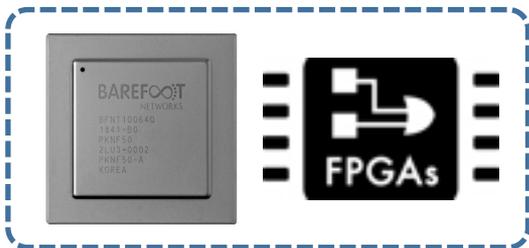


200 Gbps

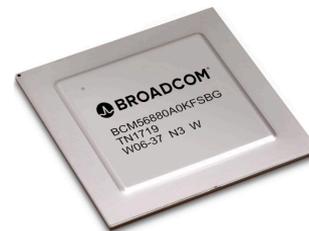


200 Gbps

Under the radar ...

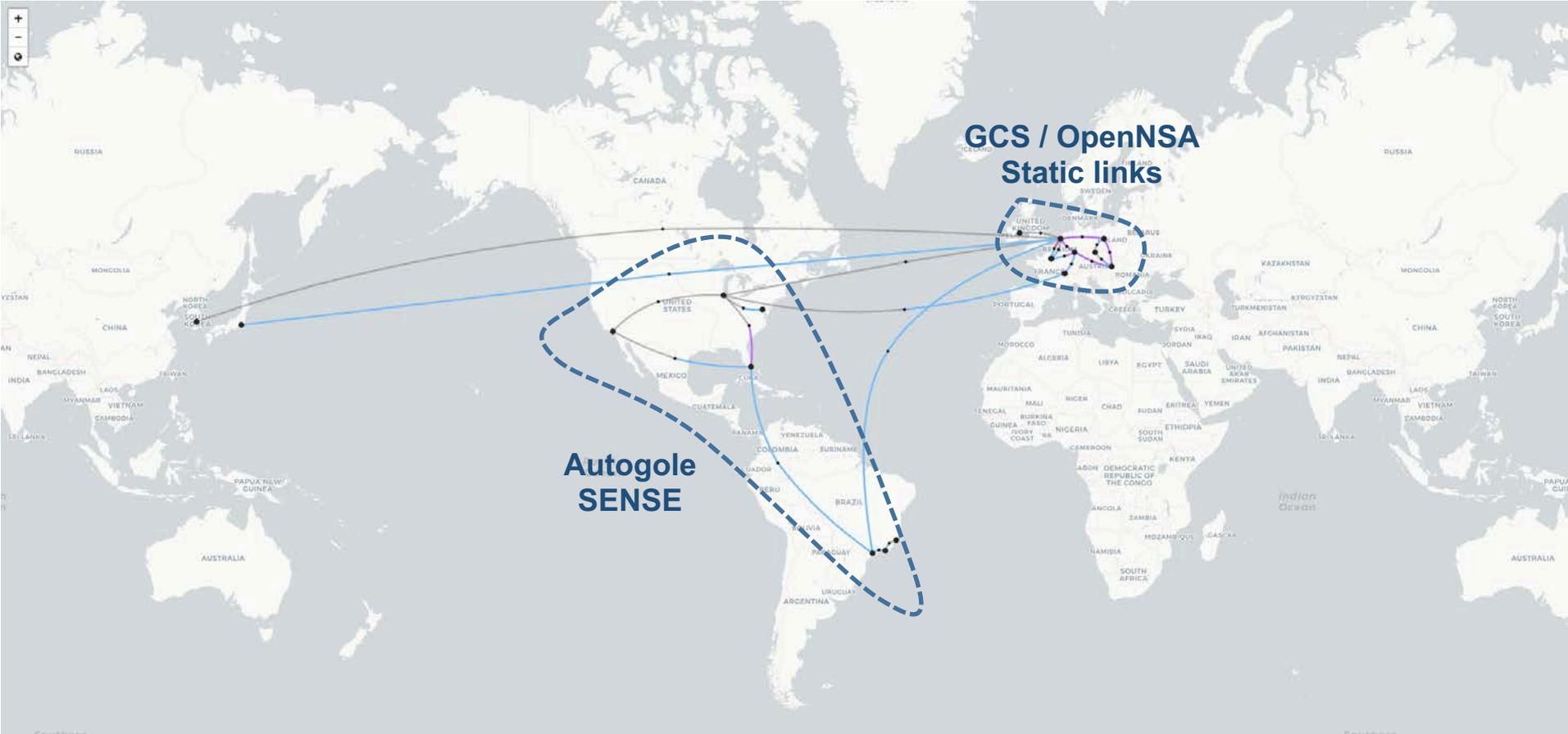


12.8 Tbps



12.8 Tbps

Global P4 lab: Links



Global P4 lab: Monitoring NMaasO

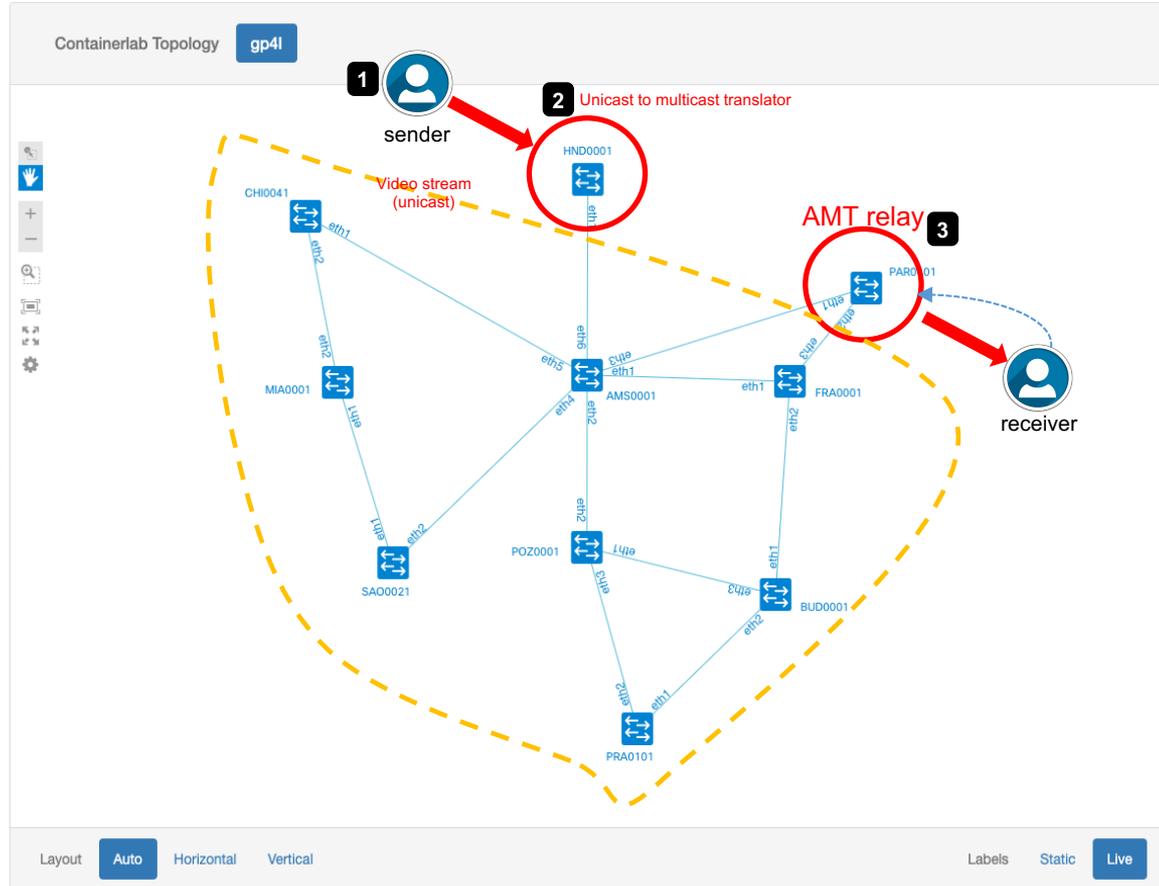
 <p>Grafana ★★★★★5</p> <p>Open source analytics & monitoring solution for every database</p>	 <p>Prometheus ★★★★★5</p> <p>Monitoring system & time series database</p>	 <p>Icinga2 ★★★★★0</p> <p>Scalable and extensible monitoring system</p>	 <p>SPA Inventory ★★★★★0</p> <p>Resource and Service Inventory with TMF-compliant API</p>
 <p>Routinator ★★★★★0</p> <p>RPKI Validator</p>	 <p>WebDAV Server ★★★★★5</p> <p>WebDAV Server with Git versioning</p>	 <p>Uptime Kuma ★★★★★5</p> <p>Self-hosted monitoring tool like "Uptime Robot"</p>	 <p>NetBox ★★★★★5</p> <p>Infrastructure resource modeling application</p>
 <p>WiFiMon ★★★★★0</p> <p>Wireless Crowdsourced Performance Monitoring and...</p>	 <p>Zabbix ★★★★★0</p> <p>Enterprise-class monitoring solution for networks and applications</p>	 <p>SPA ★★★★★0</p> <p>SPA for the E-Line service</p>	 <p>Healthchecks ★★★★★0</p> <p>A cron monitoring tool</p>

kubernetes
inside

GP4L usage: Network experiment → Multicast with **RARE!**

- 1- BIER MPLS core
- 2- AMT-relay
(AMT=Automatic Multicast Tunnel)
- 3- Unicast → Multicast translator
- 4- Can you guess the missing piece of the puzzle ?

**(S,G) advertisement !
(Application software?)**



GP4L usage: Network experiment → Multicast with **RARE** !

```

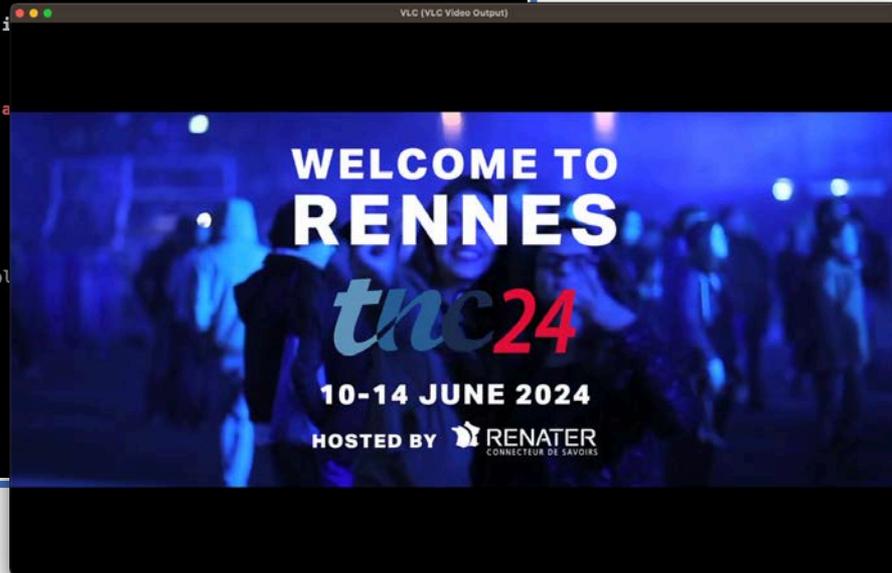
PAR0101#show ipv4 nat CLEARNET translations
          original                               translated
proto  source          target          source          target          age      last      timeout  pack   byte
-----
17     62.40.109.125 34831        62.40.109.31 57453        232.123.41.49 1234    14:49:53 00:00:00 00:01:00 17750667 20732779056
17     62.40.109.125 42455        62.40.109.31 2262        62.40.109.31 58916    232.123.64.22 1234    14:49:53 00:00:00 00:01:00 44792394 52317516192
17     62.40.109.125 54017        62.40.109.31 2262        62.40.109.31 58946    232.123.9.30 1234    14:49:53 00:00:00 00:01:00 95777049 111867593232
17     62.40.109.125 58920        62.40.109.31 2262        62.40.109.31 61381    232.123.97.117 1234    14:49:53 00:00:00 00:01:00 30054341 35103470288
  
```

Multicast (S,G)

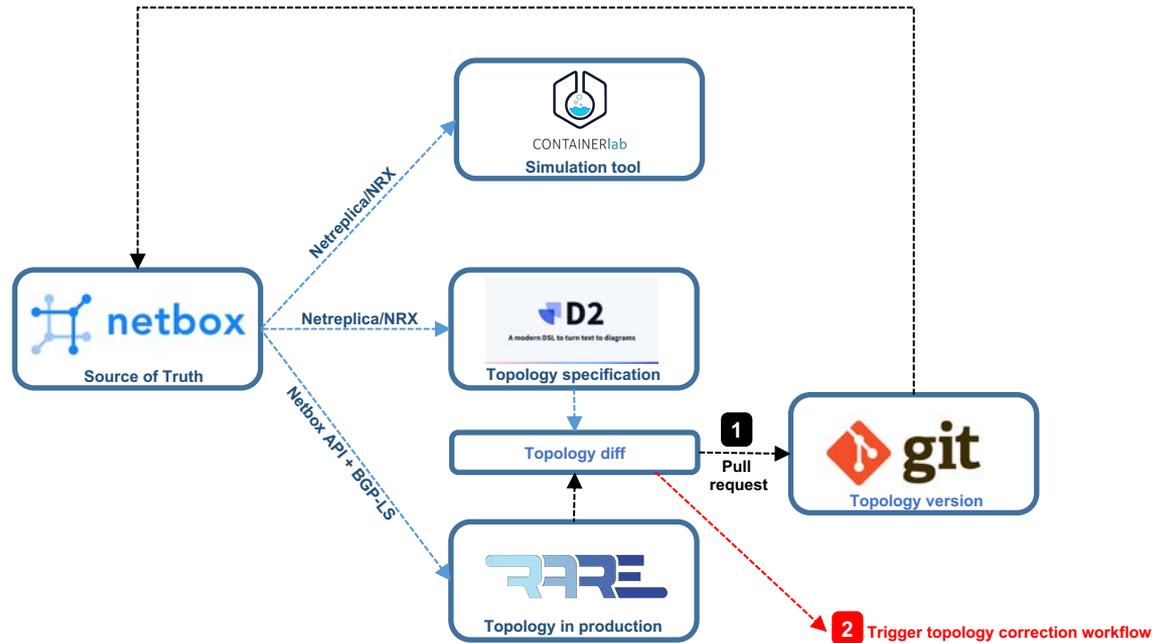
AMT-relay

```

> vlc amt://62.40.109.31@232.123.41.49:1234 --amt-relay 62.40.109.31
VLC media player 4.0.0-dev-Otto-Christ (revision 4.0.0-dev-21200-g374142361a)
[000060000051c000] main libvlc: Running vlc with the default interface. Use 'cvlc' to use vlc without i
[000060000010280c0] bonjour services discovery: starting discovery
[00006000001018d80] upnp services discovery: Initializing libupnp on 'utun3' interface
[00006000001021260] main services discovery error: cannot join multicast group: Invalid argument
[00006000001021260] main services discovery error: cannot join multicast group: Can't assign requested a
[00006000001021260] main services discovery error: cannot join multicast group: Invalid argument
[00006000001021260] main services discovery error: cannot join multicast group: Invalid argument
[00006000001021260] main services discovery error: cannot join multicast group: Invalid argument
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[00006000001021260] main services discovery error: cannot join multicast group: Invalid argument
2023-09-07 12:09:00.941 VLC[21907:808725] Warning: Column selection is not supported in view-based tabl
00>).
2023-09-07 12:09:01.137 VLC[21907:808725] Can't find app with identifier com.apple.iTunes
[0000600000d0df80] amt access error: Native multicast receive time-out
2023-09-07 12:09:05.906 VLC[21907:808725] Can't find app with identifier com.apple.iTunes
[000060000054b840] window_macosx window: using the macOS new video output window module
[00007f892a80aa00] videotoolbox decoder: Using Video Toolbox to decode 'h264'
[00007f892a80aa00] main decoder error: buffer deadlock prevented
[00007f892a80aa00] videotoolbox decoder: Using Video Toolbox to decode 'h264'
  
```



GP4L usage: Tools conception “around” the network ecosystem – Digital twin



Via GP4L Automation & Orchestration

GP4L Orchestration: The Goal



Orchestrate different components of the GP4L management environment in a user transparent way

User actions in one management tool trigger automated reactions in other tools/systems/devices

User does not need to do anything other than essential actions

Automation & Orchestration Use Case

User keeps inventory up-to-date
= Single Source of Truth

- Essential information for all GP4L devices

Auto devices' health monitoring

Auto network device configuration backup



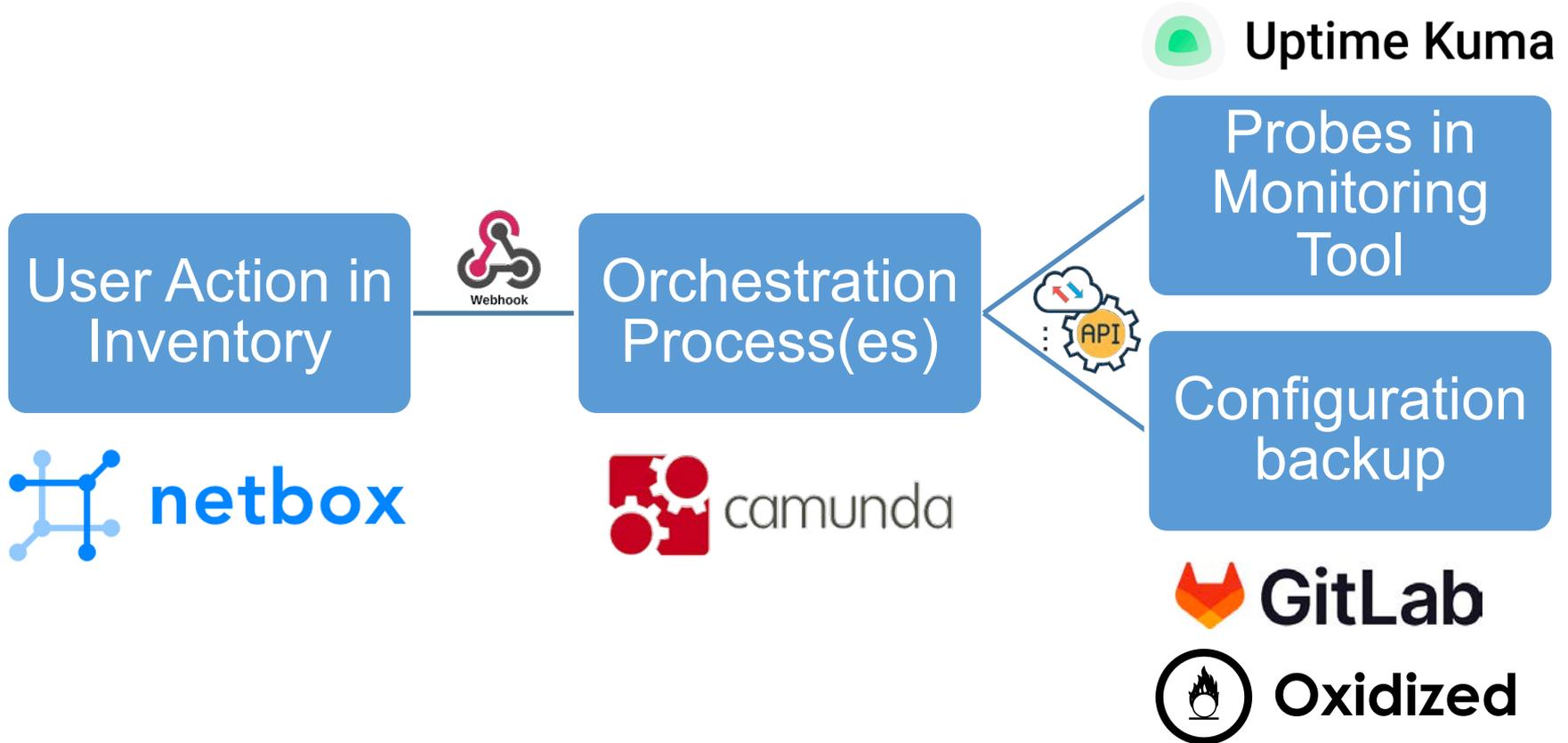
Keep track of any subsequent device changes

Retain history whenever possible



Delete / deactivate = pause

Use Case Tools



Relevant device information in NetBox

The screenshot displays the NetBox web interface for a specific device, GP4L-AMS-01. The interface is dark-themed and includes a sidebar on the left with navigation options like Organization, Devices, and various device types and components. The main content area is divided into several sections:

- Device Information:** Shows the device name (GP4L-AMS-01), creation and update timestamps, and tabs for Device, Interfaces (1), Config Context, Render Config, Contacts, Journal, and Changelog.
- Device Details:** A table listing attributes such as Region, Site (GEANT), Location, Rack, Position, Tenant, Device Type (siemens 234 (1U)), Description, Airflow, Serial Number, Asset Tag, and Config Template.
- Management:** Displays the device's status (Active), role (router), platform, and IP addresses (Primary IPv4: 172.16.26.151, Primary IPv6: —).
- Tags:** Lists tags associated with the device, such as oxidized:group:wedge-bf100-32x and oxidized:model:rare.
- Services:** A table for listing services, currently showing no results.
- Images:** A table for listing image attachments, currently showing no results.

Red boxes highlight the device name, the 'Active' status, the Primary IPv4 address, and the Tags section.

Tracking User Actions

Add new
device/interface

Change
device/interface
properties

Remove
device/interface

Uptime Kuma information synchronisation

Search All Objects admin

Devices

+ Add Import Export

Results 5 Filters

Quick search

Configure Table

Name	Status	Tenant	Site	Location	Rack	Role	Manufacturer	Type	IP Address
<input type="checkbox"/> GP4L-AMS-01	Active	—	geant	—	—	router	siemens	234	194.149.137.199/24
<input type="checkbox"/> GP4L-PAR-01	Active	—	geant	—	—	router	siemens	234	—
<input type="checkbox"/> GP4L-PAR-02	Active	—	geant	—	—	router	siemens	234	194.149.137.199/24
<input type="checkbox"/> GP4L-POZ-01	Offline	—	geant	—	—	router	siemens	234	140.82.121.4/32
<input type="checkbox"/> GP4L-POZ-02	Active	—	geant	—	—	router	siemens	234	83.97.93.30/32

Per Page Showing 1-5 of 5

+ Add Components Edit Selected Delete Selected

Uptime Kuma New Update Status Pages Dashboard

+ Add New Monitor

Search...

- 100% GP4L-AMS-01[25]
- 3.21% GP4L-PAR-02[16]
- 100% GP4L-POZ-02[14]

GP4L-AMS-01[25]
Ping: 194.149.137.199

Pause Edit Delete

Up

Check every 60 seconds

Ping	Avg. Ping	Uptime	Uptime
(Current)	(24-hour)	(24-hour)	(30-day)
47.5 ms	47 ms	100%	100%

Recent

Clear Data

Status	DateTime	Message
Up	2023-05-19 10:17:32	

Uptime Kuma information synchronisation – part 2

The screenshot displays the Uptime Kuma interface with the following components:

- Header:** Search bar, 'All Objects' filter, user 'admin', 'Uptime Kuma' title, 'New Update' button, 'Status Pages', and 'Dashboard' link.
- Devices Section:**
 - Buttons: '+ Add', '+ Import', '+ Export', '+ Add New Monitor'.
 - Search: 'Quick search' and 'Configure Table'.
 - Table:
- Monitor Card (GP4L-renamed[15]):**
 - Search: 'Search...'.
 - Progress bars for various monitors: GP4L-AMS-01[25] (100%), GP4L-PAR-02[16] (3.9%), GP4L-POZ-01[23] (100%), GP4L-renamed[15] (0%), GP4L-POZ-02[14] (100%).
 - Buttons: 'Pause', 'Edit', 'Delete'.
 - Visual indicator: A 'Down' button next to a red progress bar.
 - Text: 'Check every 60 seconds'.
 - Summary Table:
- Log Section:**
 - Table with columns: Status, DateTime, Message.
 - Entry: **Down** | 2023-05-19 10:31:50 | PING 150.254.160.152 (150.254.160.152) 56(84) bytes of data. --- 150.254.160.152 ping statistics --- 10 packets transmitted, 0 received, 100% packet loss, time 210ms.
 - Button: 'Clear Data'.
- Notification:** A green toast message at the bottom: 'Modified device GP4L-POZ-01'.

Oxidized information synchronisation

Devices

Results 5 Filters

Quick search

Name	Status	Tenant	Site	Location	Rack	Role	Manufacturer	Type	IP Address
<input type="checkbox"/> GP4L-AMS-01	Active	—	GEANT	—	—	router	siemens	234	172.16.26.151/24
<input type="checkbox"/> GP4L-PAR-01	Active	—	GEANT	—	—	router	siemens	234	172.16.26.156/24
<input type="checkbox"/> GP4L-PAR-02	Active	—	GEANT	—	—	router	siemens	234	192.168.122.126/24
<input type="checkbox"/> GP4L-POZ-01	Active	—	GEANT	—	—	router	siemens	234	172.16.26.154/24
<input type="checkbox"/> 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

2023-09-05 15:43 CEST rare-netbox-1069-nmaas-netbox-59868df758-pxcsp (v3.5.2)

Oxidized Stats Migration

Search in Configs

nodes /

Show / hide columns Refresh Reload

Show 50 entries Search:

Name	Model	Group	Last Status	Last Update	Last Changed	Actions
GP4L-AMS-01	RARE	wedge-bf100-32x	■	2023-09-05 15:44:42 CEST	unknown	🔍 📄 🔄
GP4L-PAR-01	RARE	wedge-bf100-32x	■	2023-09-05 15:44:47 CEST	unknown	🔍 📄 🔄
GP4L-PAR-02	RARE	wedge-bf100-32x	■	2023-09-05 15:44:53 CEST	unknown	🔍 📄 🔄
GP4L-POZ-01	RARE	wedge-bf100-32x	■	2023-09-05 15:45:01 CEST	2023-09-05 15:45:02 CEST	🔍 📄 🔄
GP4L-POZ-02	RARE	wedge-bf100-32x	■	2023-09-05 15:45:08 CEST	2023-09-05 15:45:10 CEST	🔍 📄 🔄

Showing 1 to 5 of 5 entries

Previous 1 Next

Oxidized v.0.28.0

Oxidized information synchronisation – part 2

Search admin

Devices

+ Add Import Export

Results 5 Filters

Quick search Configure Table

Name	Status	Tenant	Site	Location	Rack	Role	Manufacturer	Type	IP Address	
<input type="checkbox"/> GP4L-AMS-renamed	Active	—	GEANT	—	—	router	siemens	234	172.16.26.151/24	
<input type="checkbox"/> GP4L-PAR-01	Active	—	GEANT	—	—	router	siemens	234	<input type="text" value="—"/>	
<input type="checkbox"/> GP4L-PAR-02	Active	—	GEANT	—	—	router	siemens	234	192.168.122.126/24	
<input type="checkbox"/> GP4L-POZ-01	Planned	—	GEANT	—	—	router	siemens	234	172.16.26.154/24	
<input type="checkbox"/> 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

2023-09-05 16:13 CEST rare- Modified device GP4L-AMS-renamed

Oxidized Stats Migration Search in Configs

nodes /

Show / hide columns Refresh Reload

Show 50 entries Search:

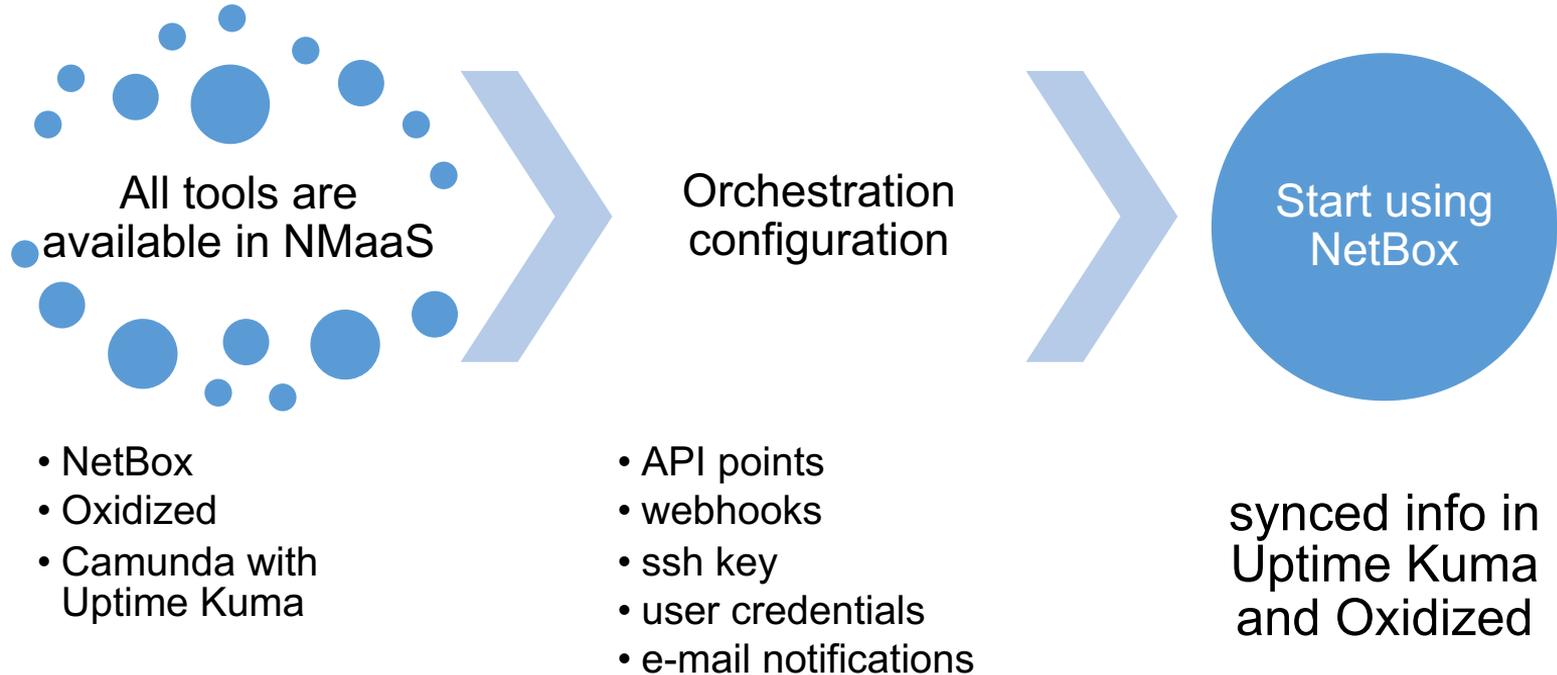
Name	Model	Group	Last Status	Last Update	Last Changed	Actions
GP4L-AMS-renamed	RARE	wedge-bf100-32x	■	2023-09-05 16:15:19 CEST	2023-09-05 16:15:20 CEST	
GP4L-PAR-02	RARE	wedge-bf100-32x	■	2023-09-05 16:15:09 CEST	unknown	
GP4L-POZ-02	RARE	wedge-bf100-32x	■	2023-09-05 16:15:14 CEST	unknown	

Showing 1 to 3 of 3 entries

Previous 1 Next

Oxidized v.0.28.0

Ready, Set, Go!



Get the tools to talk to each other...

Webhooks

Results 2 Filters

Quick search

Name	Object types	Enabled	Create	Update	Delete	Job start	Job end	HTTP method	URL
device-webhook	Device	✓	✗	✓	✓	✗	✗	POST	https://gp4l-orch.rare.nmaas.eu/custom-api/process-notification
ipadress	IP Address	✓	✗	✗	✓	✗	✗	POST	https://gp4l-orch.rare.nmaas.eu/custom-api/process-notification

Per Page -

Showing 1-2 of 2

Edit Selected Delete Selected



2023-09-05 16:00 CEST rare-netbox-1069-nmaas-netbox-59868df758-prxsp (v3.5.2)

NMaas

Applications

Subscriptions

Instances

Domain: RARE -

sonja.filiposka -

CAMUNDA

Configuration

Base

Username for the Camunda administrator *

admin

Password for the Camunda administrator *

.....

Default Camunda email recipient *

Send email on create *

Yes

No

Send email on modify *

Yes

No

Send email on pause *

Yes

No

Send email on resume *

Yes

No

NetBox API URL *

General Camunda

E-mail notifications setup

Cancel

camunda

Configuration

NetBox API URL *

https://netbox.example.com

NetBox API token *

Suggested format: 0123456789abcdef0123456789abcdef01234567

Username for the Uptimekuma web user *

Password for the Uptimekuma web user *

Password for the Uptimekuma API *

Oxidized Git repository URL *

ssh://...

Email addresses to receive the generated repository access SSH public key *

example1@example.com, example2@example.com

The name to use for all Git commits created by Camunda *

The email to use for all Git commits created by Camunda *

Apply configuration

Cancel

NetBox API

Uptime Kuma GUI & API

Git & Oxidized

Future work

This use case targets the GP4L admin side

Next: Introduce automation and orchestration for the GP4L users

- Reservation booking process
- Automated monitoring
- Automated configuration handling

Thank You!

Any question or comment? Please contact us at

gn5-1-wp6-t2-gp4lab@lists.geant.org