



Global P4 Lab

Frédéric Loui, RENATER

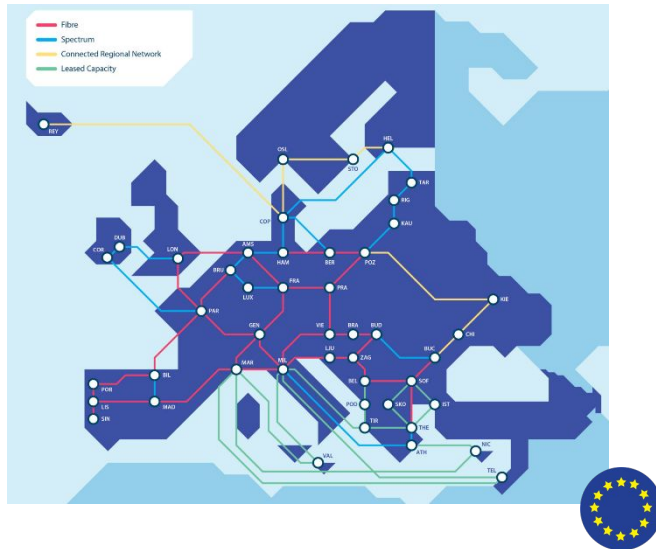
Ivana Golub, PSNC

4th Global Research Platform

October 9-10, Limassol, Cyprus

Public (PU)

GÉANT – European Network Infrastructure, Services and Community



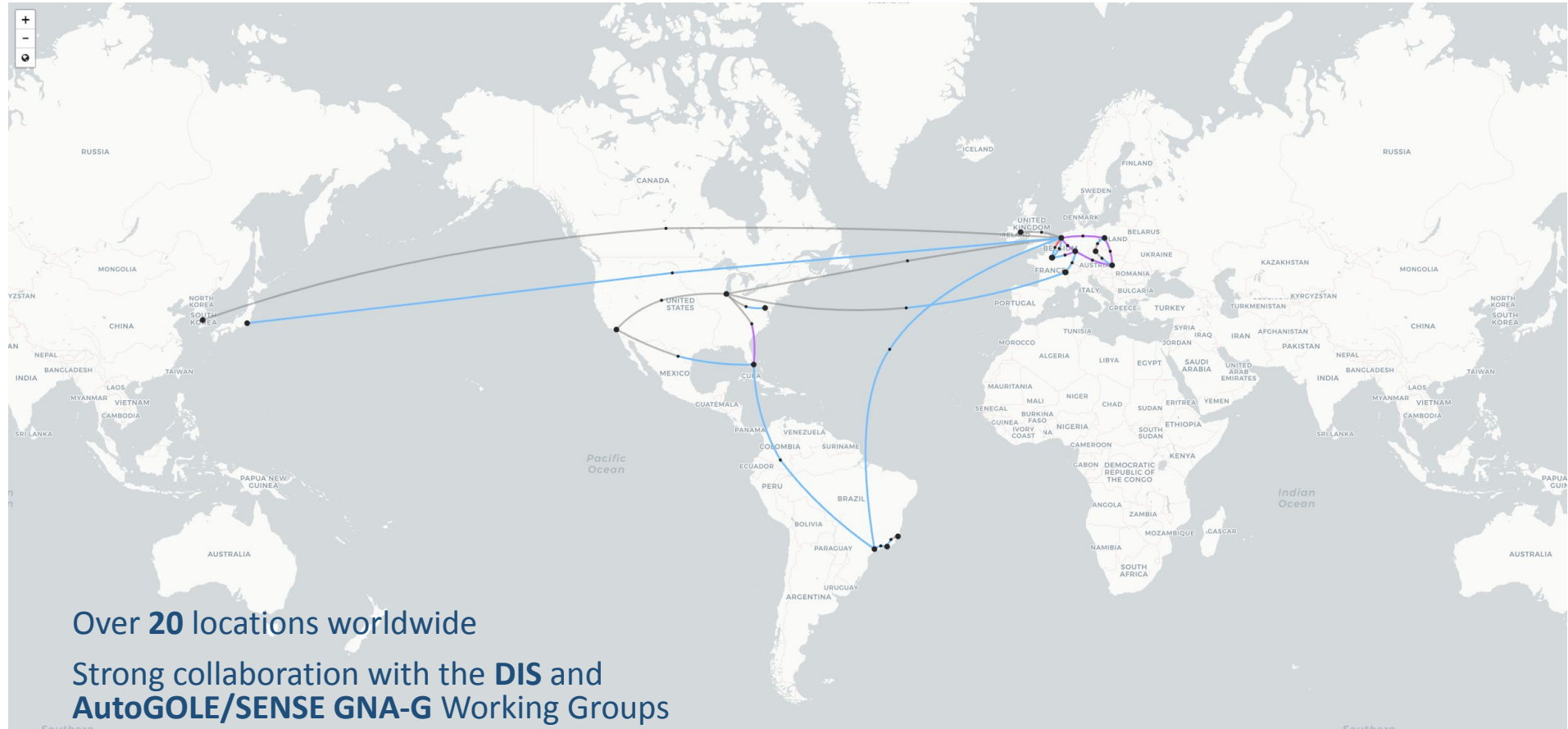
The GÉANT-5 project is under Horizon Europe Research and innovation funding programme until 2027



- High bandwidth, high speed and highly resilient pan-European backbone
- Interconnecting European NRENs
- over 20 years of support for Europe's research and education communities

- 37 partners
- 500 contributors
- 50M users

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



Global P4 lab: Node types

Available now in GP4L !



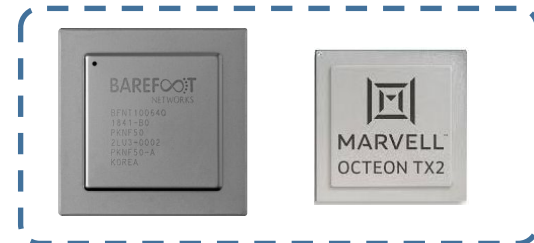
3.2/6.4 Tbps



12.8 Tbps



200 Gbps

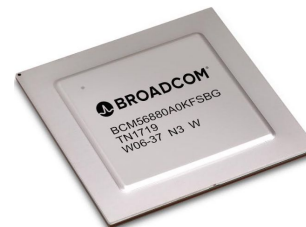


200 Gbps

Under the radar ...



12.8 Tbps



12.8 Tbps

RARE/freeRtr in a nutshell

RARE is an open source routing platform, used to create a network operating system (NOS) on commodity hardware (a white box switch).

RARE uses FreeRtr as a control plane software and is thus often referred to as RARE/freeRtr

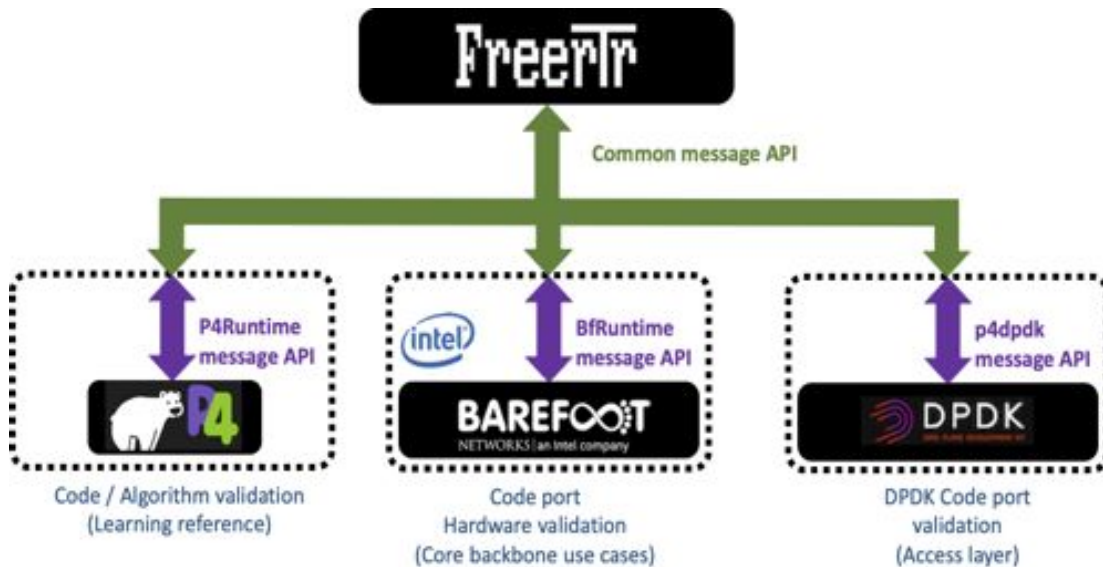


More information:

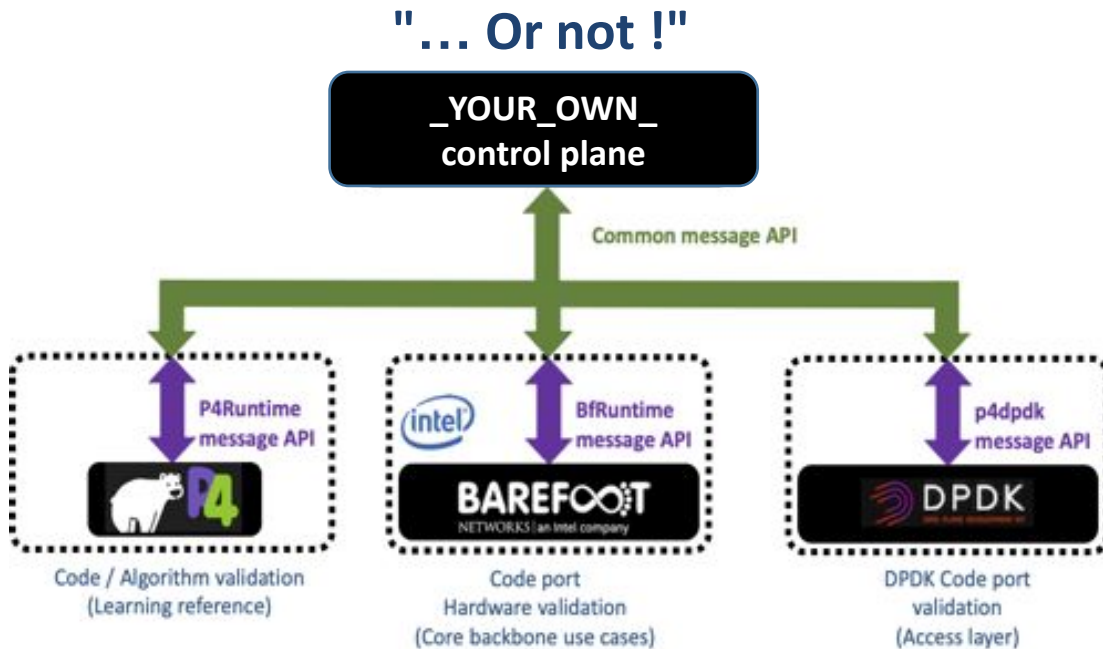
<https://wiki.geant.org/display/rare>

RARE/freeRtr in a nutshell

"One control plane to rule them all ..."



RARE/freeRtr in a nutshell



RARE - Router for Academia, Research and Education

An open source router OS for R&E use cases

Supports six data planes:

- based on UNIX socket
- Libpcap
- DPDK
- BMv2 (P4)
- INTEL TOFINO ASIC (P4)
- XDP, eXpress Data Path

RARE features (not limited to):

- Interior Routing Protocol
- Dataplane forwarding
- External Routing Protocol
- Link local protocol
- Network management



[RARE](https://www.rare-project.org/)

rare-users@lists.geant.org

rare-dev@lists.geant.org

rare@lists.geant.org

Complete feature list

Type	Test #	Name				
acl	01*	copp	✓	✓	✓	✗
acl	02*	ingress access list	✓	✓	✓	✗
acl	03*	egress access list	✓	✓	✓	✗
acl	04*	nat	✓	✓	✓	✗
acl	05*	vlan ingress access list	✓	✓	✓	✗
acl	06*	vlan egress access list	✓	✓	✓	✗
acl	07*	bundle ingress access list	✓	✓	✓	✗
acl	08*	bundle egress access list	✓	✓	✓	✗
acl	09*	bundle vlan ingress access list	✓	✓	✓	✗
acl	10*	bundle vlan egress access list	✓	✓	✓	✗
acl	11*	bridge ingress access list	✓	✓	✓	✗
acl	12*	bridge egress access list	✓	✓	✓	✗
acl	13*	vlan bridge ingress access list	✓	✓	✓	✗
acl	14*	vlan bridge egress access list	✓	✓	✓	✗
acl	15*	ingress pppoe access list	✓	✓	✓	✗
acl	16*	egress pppoe access list	✓	✓	✓	✗
acl	17*	ingress vlan pppoe access list	✓	✓	✓	✗
acl	18*	egress vlan pppoe access list	✓	✓	✓	✗
acl	19*	hairpin ingress access list	✓	✓	✓	✗
acl	20*	hairpin egress access list	✓	✓	✓	✗
acl	21*	hairpin vlan ingress access list	✓	✓	✓	✗
acl	22*	hairpin vlan egress access list	✓	✓	✓	✗
acl	23*	hairpin pppoe ingress access list	✓	✓	✓	✗
acl	24*	hairpin pppoe egress access list	✓	✓	✓	✗
acl	25*	hairpin vlan pppoe ingress access list	✓	✓	✓	✗
acl	26*	hairpin vlan pppoe egress access list	✓	✓	✓	✗
acl	27*	ingress gre access list	✓	✓	✓	✗
acl	28*	egress gre access list	✓	✓	✓	✗
acl	29*	ingress vlan gre access list	✓	✓	✓	✗

Liaison with GNS-1 WP6-T2 platform – Global P4 Lab

GP4L
GEANT P4 LAB

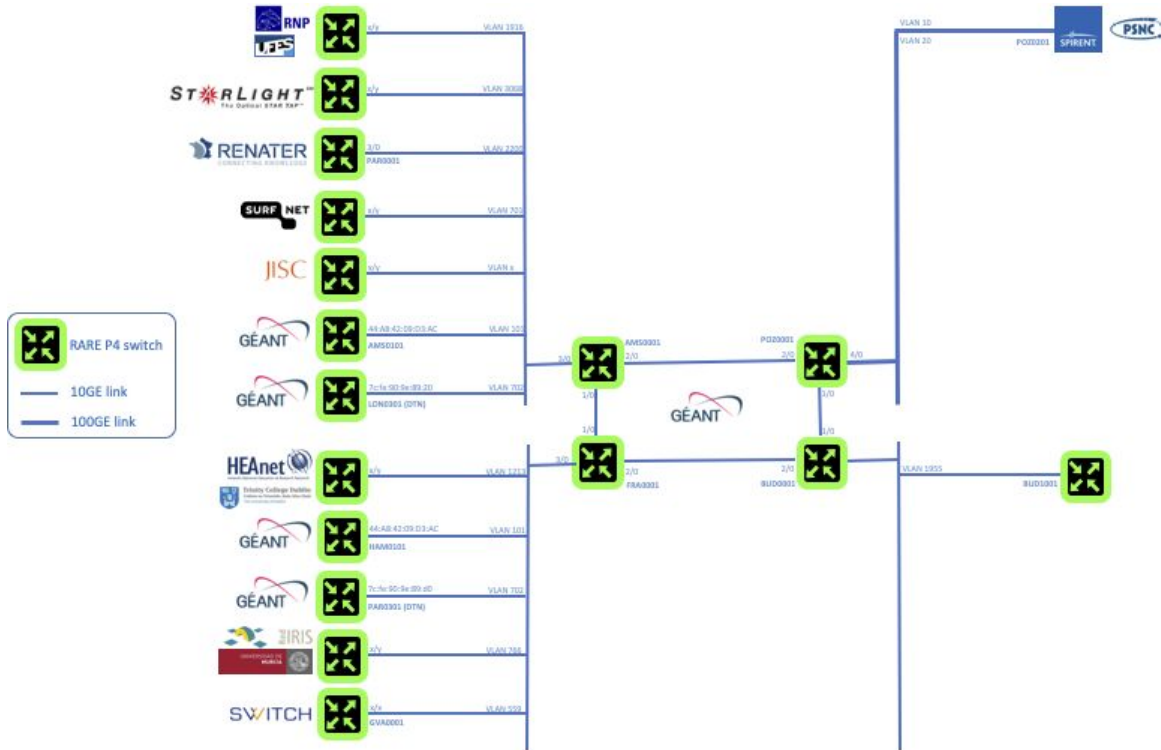
- December 2019



Liaison with GN5-1 WP6-T2 platform – Global P4 Lab

GP4L
GEANT P4 LAB

- December 2020



GP4L - GÉANT P4Lab

P4 switch-based lab infrastructure interconnected through the GÉANT network

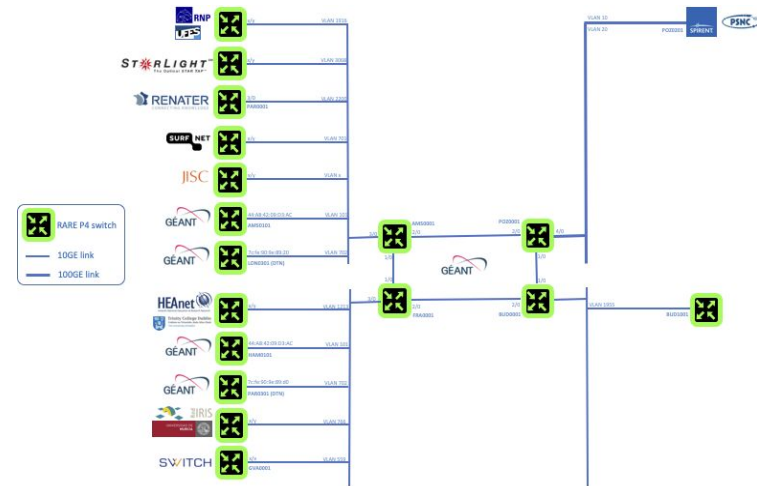
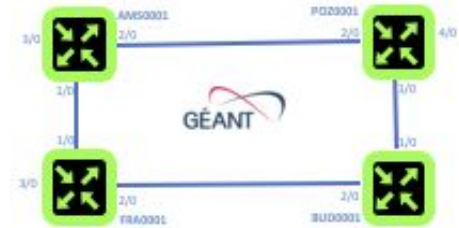
- 4 switches in Europe: AMS, POZ, FRA, BUD

Validation of the RARE/FreeRtr OS routing stack software

World-wide testbed, offering **experimental dataplane programming facilities to researchers** to perform geographically distributed network experiments:

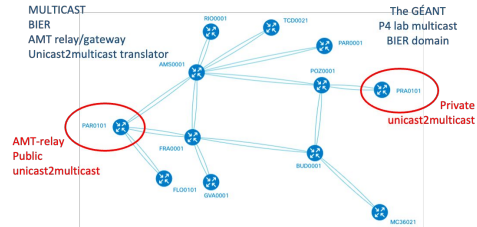
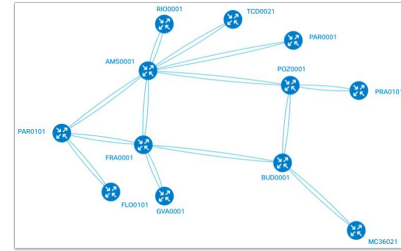
- With the usage of RARE/FreeRtr NOS
- Using a clean slate environment (i.e use exclusively GP4L without RARE/FreeRtr dataplane & control plane)

GP4L GÉANT P4 LAB



Previous GP4L Use Cases

- Topology Monitoring with BGP-LS
- Next Generation Multicast with AMT relay/gateway and Unicast to Multicast translator, Juniper and Akamai
- Polka - an innovative source routing paradigm, IFES/UFES
- Packet Marking Specification: IPv6 Flow Label, CERN
- SuperComputing22 Demo, GNA-G DIS



Bits 12 - 13	Bits 14 - 22	Bit 23	Bits 24 - 29	Bits 30 - 31
Entropy	Entropy	Entropy	Application	Entropy
Application: Science Domains: Reserved - 0 Default - 45536 ALICE - 52768 CMS - 89394 LHCb - 149394 ALICE - 81920 BelleII - 49352 SHA - 114688 LBT - 73728 SOLE - 81342		Application: Reserved - 0 Default - 4 PROFESSOR - 6 Cache - 12 DataChallenge - 16		

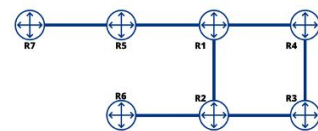
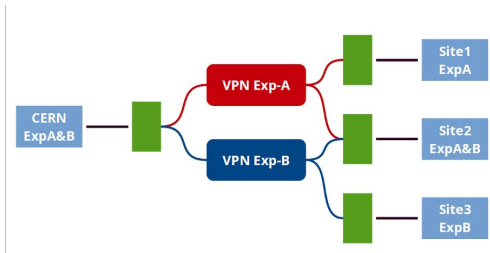


Figure 3. Edge-Core Experiment

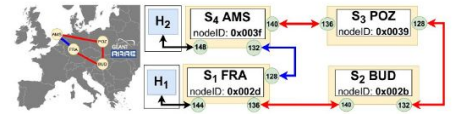
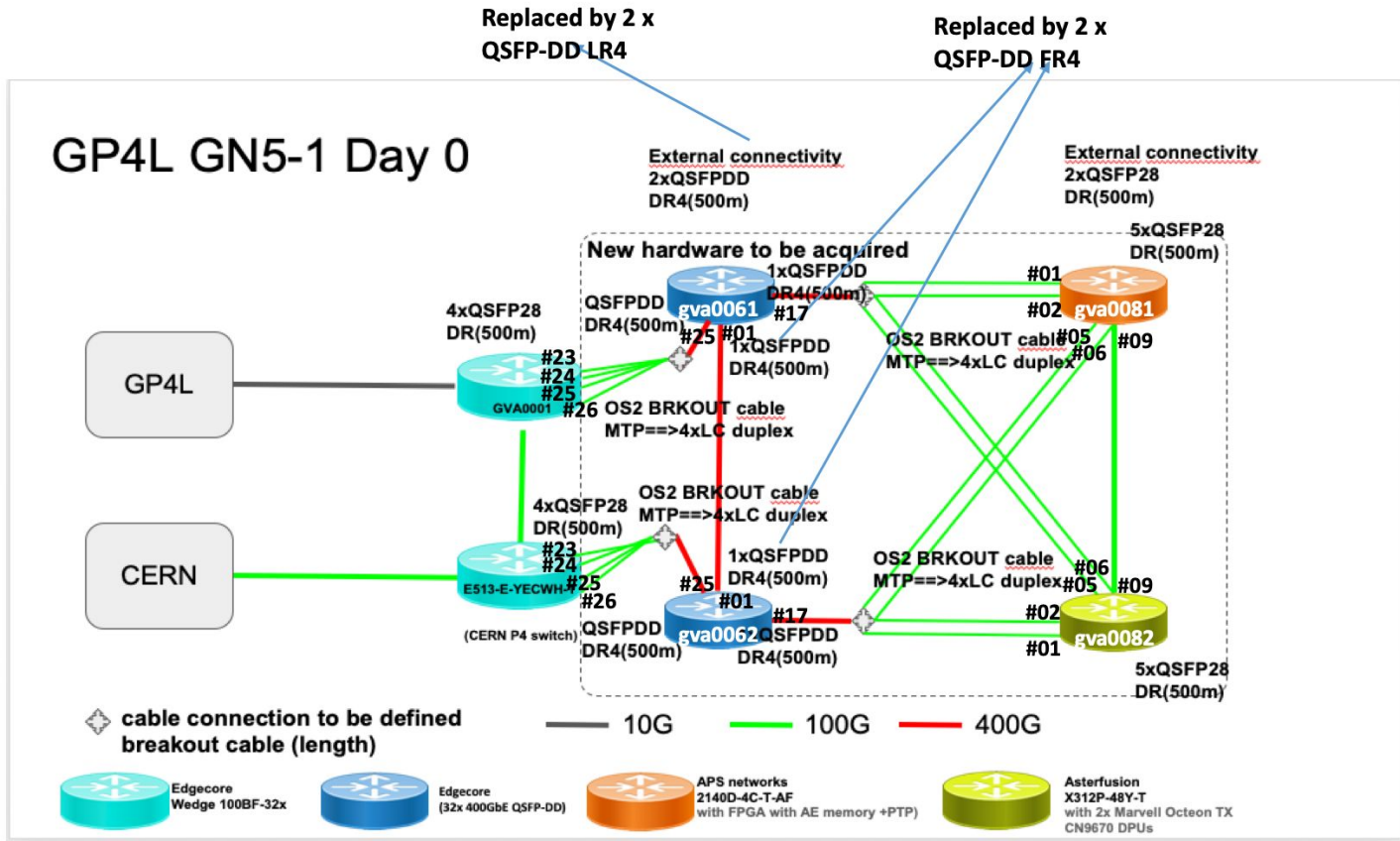


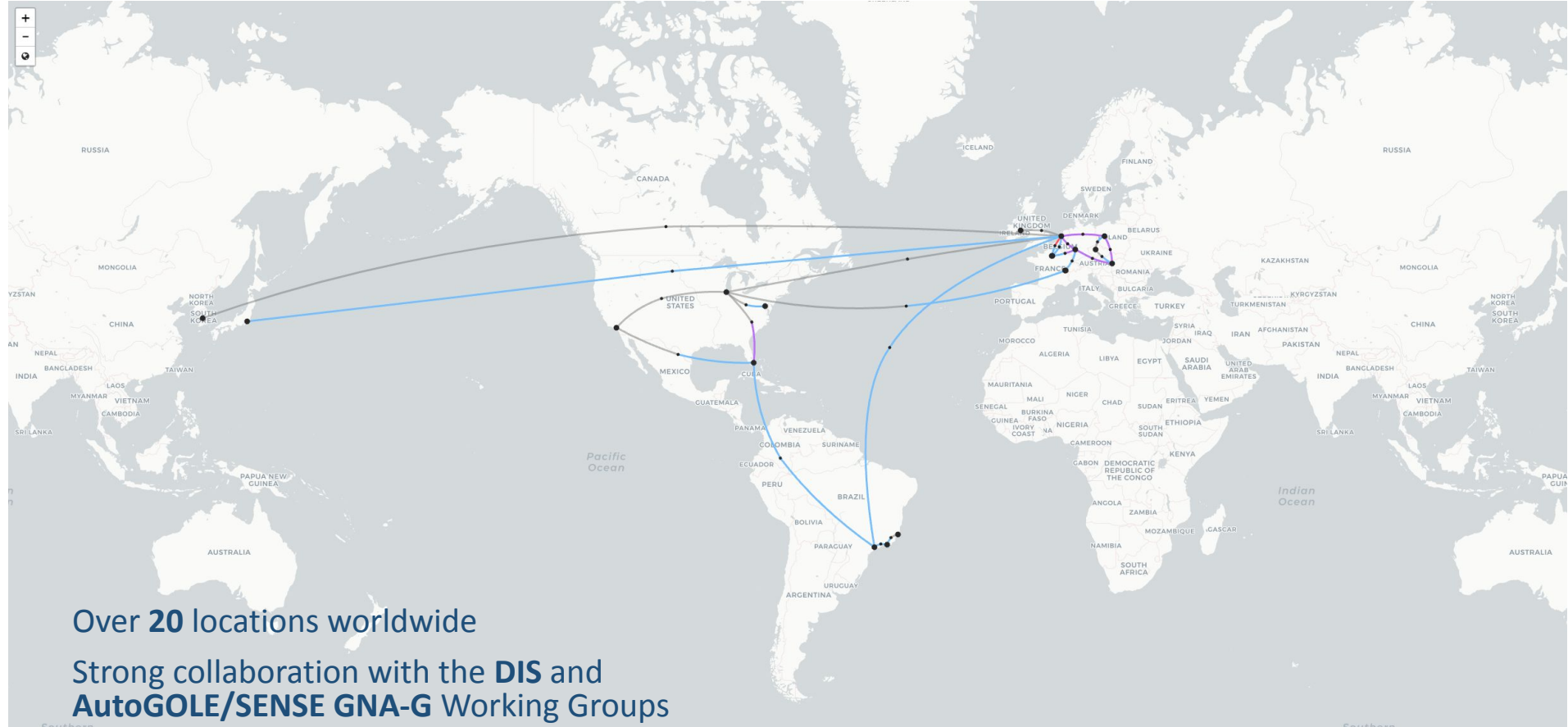
Figure 4. RARE/GEANT testbed

Global P4 lab: Extension at Geneva

GP4L GN5-1 Day 0



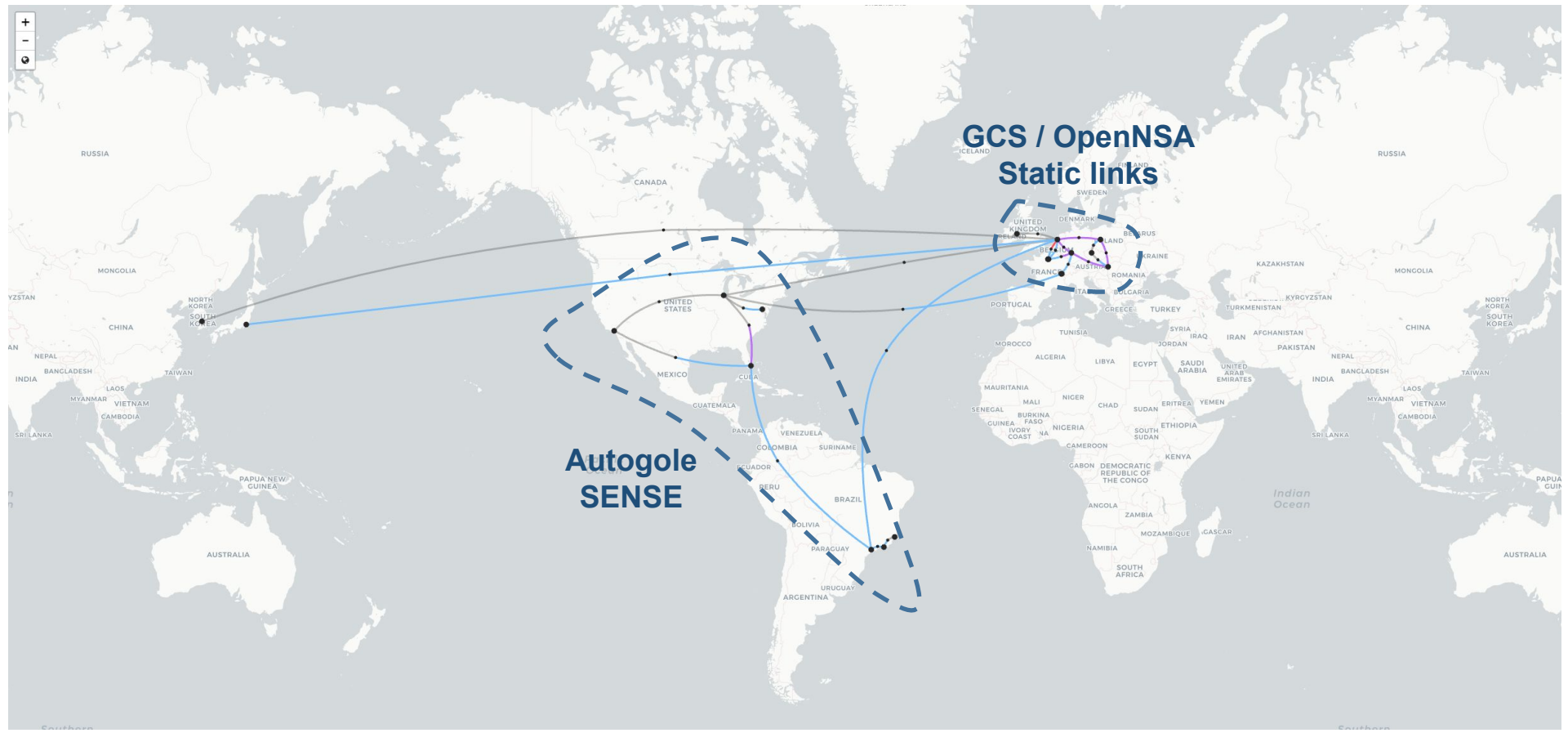
Global P4 lab: “Persistent Programmable testbed” current footprint [2023/09]



Over **20** locations worldwide

Strong collaboration with the **DIS** and **AutoGOLE/SENSE GNA-G** Working Groups

Global P4 lab: Links



GP4L Project in GN5-1 (besides test RARE/freeRTr)

- **User community**

- Listen user community request
 - Demo wish-list
 - Problem solving approach
- GP4L as an experimentation facility
 - For representative demo
 - Used to develop new network management component

- **Developer community**

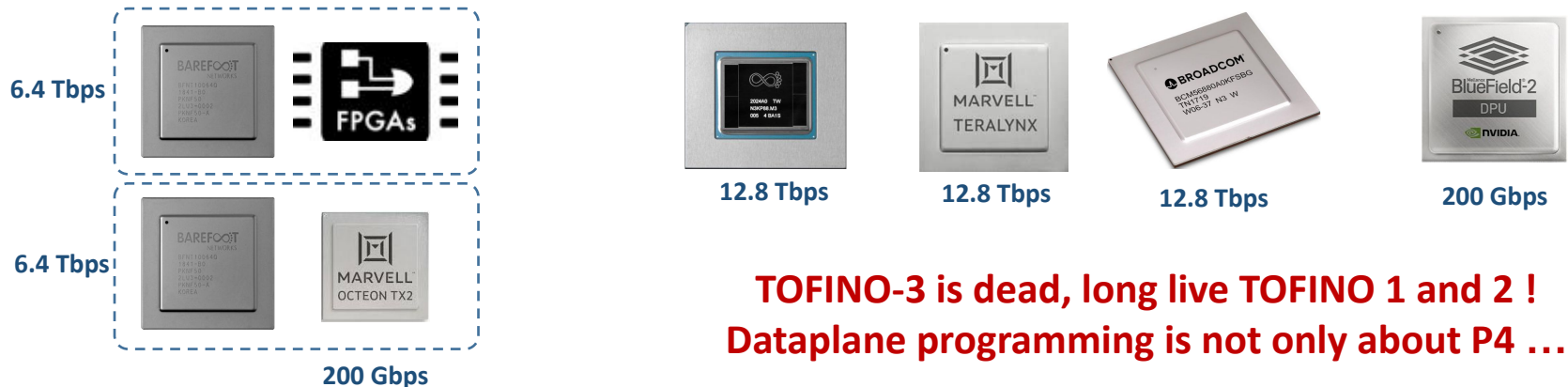
- Network orchestration (integration of NetBox, Camunda and Uptime Kuma)
- Network automation
- Network management components

Objective:

**INCREASE GP4L platform usage in both
Network usage prototyping and
facility for network development**

RARE/freeRtr feature development

- Feature development
 - Digital twin
 - Orchestration
 - Automation
 - ...
 - Please share your ideas !
- New targets (and thus new use cases)



TOFINO-3 is dead, long live TOFINO 1 and 2 !
Dataplane programming is not only about P4 ...

RARE/freeRtr Network Management as a Service

What about
GP4L
monitoring?

NMaaS - Network Management as a Service

A portfolio of network management applications run as dedicated, cloud-based per-user instance

28 applications available, easy to add new tools

Use cases:

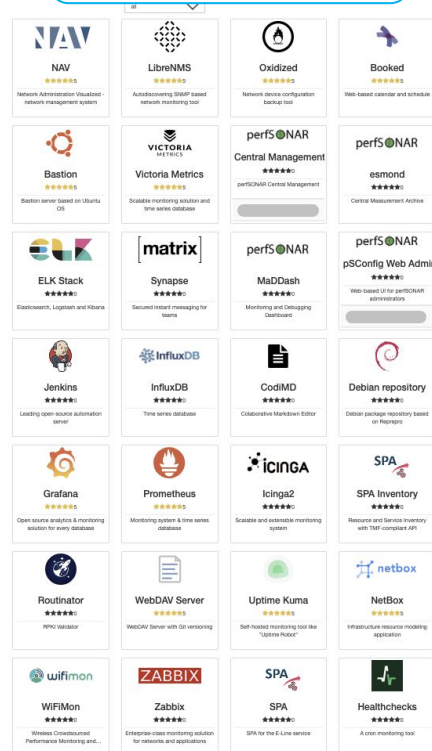
- Network/Equipment Management for Small/Medium size networks/institutions
- Project-owned equipment
- NMaaS Virtual Lab - **NEW!**

How to use NMaaS?

- Managed service
 - Production NMaaS instance: <https://nmaas.eu>
 - Sandbox instance: <https://nmaas.geant.org>
- Self-hosted
 - On your own NMaaS instance: <https://docs.nmaas.eu/install-guide>
 - On a local machine: <https://docs.nmaas.eu/local-vm>

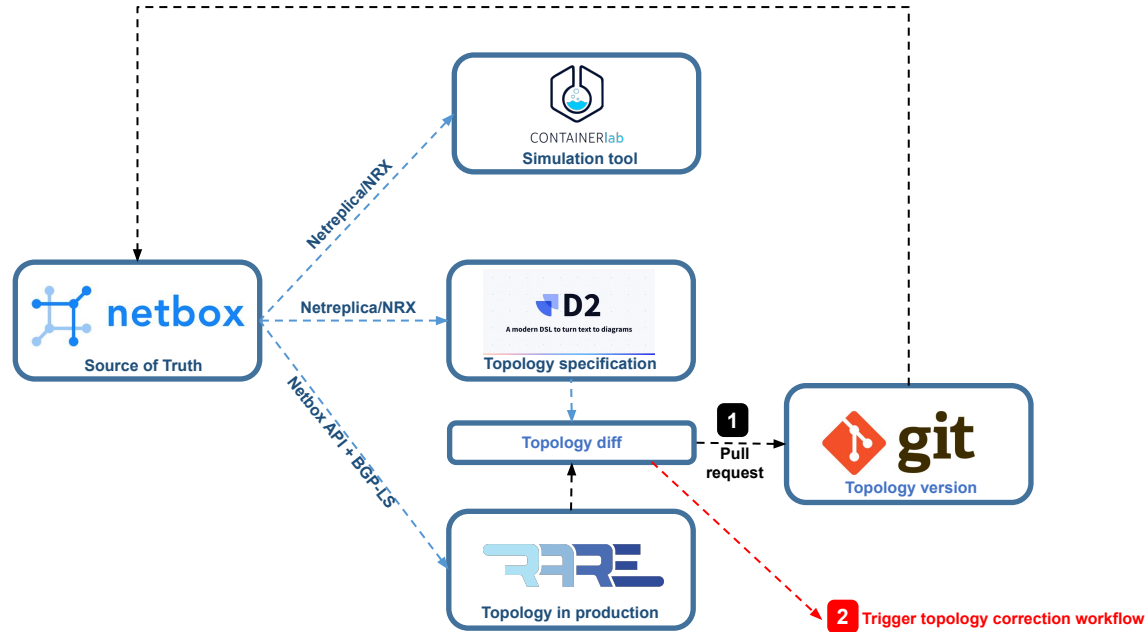
NMaaS

nmaas.eu
nmaas@lists.geant.org



kubernetes
Inside

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



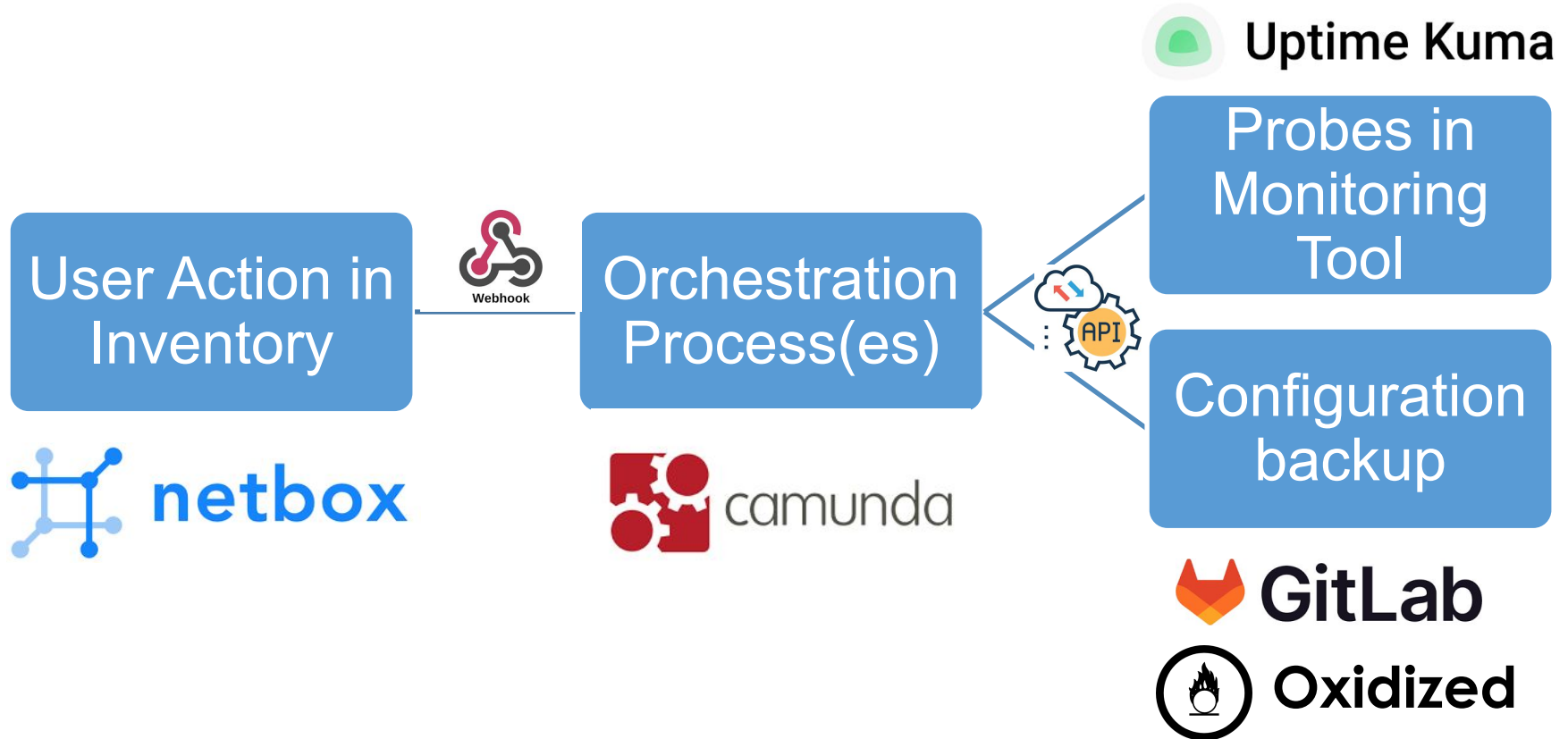
Keep track of any subsequent device changes

Retain history whenever possible



Delete / deactivate = pause

Use Case Tools



Tools

netbox

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	Planned	—	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

2023-09-05 19:12 CEST rare-netbox-1069-nmaas-netbox-59868df758-pxcsp (v3.5.2)

Uptime Kuma New Update Status Pages Dashboard

+ Add New Monitor

Quick Stats

Up 3 Down 0 Maintenance 0
Unknown 0 Pause 0

100% GP4L-AMS-01[1] 100% GP4L-PAR-02[3] 100% GP4L-POZ-02[E]

Name	Status	DateTime	Message
GP4L-POZ-02[E]	Up	2023-09-05 15:23:58	
GP4L-PAR-02[3]	Up	2023-09-05 15:20:58	
GP4L-AMS-01[1]	Up	2023-09-05 15:14:36	

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	Up	2023-09-05 19:14:31 CEST	unknown	
GP4L-PAR-02	RARE	wedge-bf100-32x	Up	2023-09-05 19:14:18 CEST	unknown	
GP4L-POZ-02	RARE	wedge-bf100-32x	Up	2023-09-05 19:14:25 CEST	unknown	

Showing 1 to 3 of 3 entries

Previous 1 Next

Oxidized v.0.28.0

Tracking User Actions

Add new
device/interface

Change
device/interface
properties

Remove
device/interface

Tools

netbox

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	Planned	—	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

+ Add Components Edit Selected Rename Delete Selected

2023-09-05 19:12 CEST rare-netbox-1069-nmaas-netbox-59868df758-pxcsp (v3.5.2)

Uptime Kuma New Update Status Pages Dashboard

+ Add New Monitor

Search...

100% GP4L-AMS-01[1] 100% GP4L-PAR-02[3] 100% GP4L-POZ-02[E]

Quick Stats

Up 3 Down 0 Maintenance 0
Unknown 0 Pause 0

Name	Status	DateTime	Message
GP4L-POZ-02[E]	Up	2023-09-05 15:23:58	
GP4L-PAR-02[3]	Up	2023-09-05 15:20:58	
GP4L-AMS-01[1]	Up	2023-09-05 15:14:36	

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 19:14:31 CEST	unknown	🔍 🗑️ 🔄
GP4L-PAR-02	RARE	wedge-bf100-32x	🟢	2023-09-05 19:14:18 CEST	unknown	🔍 🗑️ 🔄
GP4L-POZ-02	RARE	wedge-bf100-32x	🟢	2023-09-05 19:14:25 CEST	unknown	🔍 🗑️ 🔄

Showing 1 to 3 of 3 entries

Previous 1 Next

Oxidized v.0.28.0

Uptime Kuma information synchronisation

The screenshot displays the Uptime Kuma web interface. On the left, the 'Devices' section shows a table of 5 devices. The 'GP4L-POZ-01' device is highlighted with a red box and labeled 'Offline'. A red box is also drawn around the IP address '194.149.137.199/24' in the 'GP4L-PAR-01' row. On the right, the 'Uptime Kuma' monitor view for 'GP4L-AMS-01[25]' is shown, with a 'Ping: 194.149.137.199' and a status of 'Up'. A summary table shows Ping (47.5 ms), Avg. Ping (47 ms), Uptime (100%), and Uptime (100%). A line graph shows response time over time, and a table at the bottom shows the current status: 'Up' at '2023-05-19 10:17:32'. Three red arrows point from the table rows to the monitor view: one from the 'GP4L-AMS-01' row to the '100%' status, one from the 'GP4L-PAR-01' row to the '3.21%' status, and one from the 'GP4L-POZ-01' row to the '100%' status.

Devices

Results 5 Filters

Quick search

Name	Status	Tenant	Site	Location	Rack	Role	Manufacturer	Type	IP Address
GP4L-AMS-01	Active	geant	geant	geant	geant	router	siemens	234	194.149.137.199/24
GP4L-PAR-01	Active	geant	geant	geant	geant	router	siemens	234	194.149.137.199/24
GP4L-PAR-02	Active	geant	geant	geant	geant	router	siemens	234	194.149.137.199/24
GP4L-POZ-01	Offline	geant	geant	geant	geant	router	siemens	234	140.82.121.4/32
GP4L-POZ-02	Active	geant	geant	geant	geant	router	siemens	234	83.97.93.30/32

Per Page Showing 1-5 of 5

Uptime Kuma

GP4L-AMS-01[25]
Ping: 194.149.137.199

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

Pause Edit Delete

Check every 60 seconds

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

Recent

Resp. Time (ms)

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

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', 'Dashboard', and a user profile dropdown.
- Left Sidebar:** Navigation icons for Home, Devices, Status Pages, and Settings.
- Devices Section:**
 - Buttons: '+ Add', '+ Import', '+ Export', '+ Add New Monitor'.
 - Search: 'Quick search' and 'Configure Table'.
 - Table:
- Table Data:**

Name	Status	Tenant	Site	Location	Rack	Role	Manufacturer	Type	IP Address	Actions
GP4L-AMS-01	Active	—	geant	—	—	router	siemens	234	62.40.99.225/32	[Edit]
GP4L-PAR-02	Active	—	geant	—	—	router	siemens	234	194.149.137.199/24	[Edit]
GP4L-POZ-01	Active	—	geant	—	—	router	siemens	234	—	[Edit]
GP4L-POZ-02	Decommissioning	—	geant	—	—	router	siemens	234	83.97.93.30/32	[Edit]
GP4L-renamed	Active	—	geant	—	—	router	siemens	234	150.254.160.152/32	[Edit]
- Right Sidebar (GP4L-renamed[15]):**
 - Ping: 150.254.160.152
 - Buttons: 'Pause', 'Edit', 'Delete'.
 - Status: 'Down' (indicated by a red pill).
 - Check every 60 seconds.
 - Summary Table:

Ping	Avg. Ping	Uptime	Uptime
(Current)	(24-hour)	(24-hour)	(30-day)
N/A	N/A	0%	0%
- Bottom Section:**
 - Buttons: '+ Add Components', 'Edit Selected', 'Delete Selected'.
 - Notification: 'Modified device GP4L-POZ-01'.
 - Log Table:

Status	DateTime	Message
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

Oxidized information synchronisation

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-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!

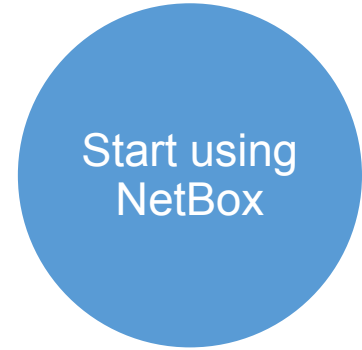


- NetBox
- Oxidized
- Camunda with Uptime Kuma



Orchestration configuration

- API points
- webhooks
- ssh key
- user credentials
- e-mail notifications



synced info in Uptime Kuma and Oxidized

Get the tools to talk to each other...

Webhooks

Results 2 Filters

Quick search


Configure Table

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-pxcsp (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 *

Cancel



NetBox API

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

General Camunda

E-mail notifications setup

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

SuperComputing23 Network Research Exhibitions (NREs)

Global P4 Lab

Marcos Schwarz, RNP
Frederic Loui, Renater

This showcase will include demonstrations of new deployed sites and interconnections with other testbeds like FABRIC and BRIDGES, Digital Twin capabilities, automated generation of real time world map topology and also support other NREs that are experimenting with at scale advanced/novel networking protocols and use cases, like PolKA (Polynomial Key-based Architecture) a stateless source routing protocol based on arithmetic operations over a polynomial encoded route label, and IPv6 Flow Label Packet Marking initiative from WLCG, called SciTags.

The GP4L Digital Twin capabilities intend to provide a platform to create automated digital copies of its network, consisting of the full topology or a partial slice of devices and links. It runs 1:1 instance of the same NOS instance that is used on GP4L, which can be used for many use cases:

- Realistic training and testing sandbox environments;
- Flexible development environment for new dataplane features;
- Faithful development of control, management and orchestration solutions which require constant validation and integration;
- Multi-vendor integration tests using other commercial and open NOSes

This Digital Twin solution is being developed based on the follow Open Source projects: [Netbox](#), [Netreplica](#), and [Containerlab](#)

Another feature in development is the automated generation of a real time world map dashboard of the network, which will dynamically import the devices and links information and coordinates from a central inventory system (Source of Truth), keeping it up to date with infrastructure changes without manual intervention. This solution is based on integrations between [GlobalNOC WorldView Panel](#), [Netbox](#), and GP4L network monitoring data.

Additionally, we are also applying the digital twin and world map generation at the RNP backbone to also demonstrate its validity with production environments based on brownfield commercial networks and showcasing their multi-vendor and multi-domain capabilities.

SuperComputing23 Network Research Exhibitions (NREs)

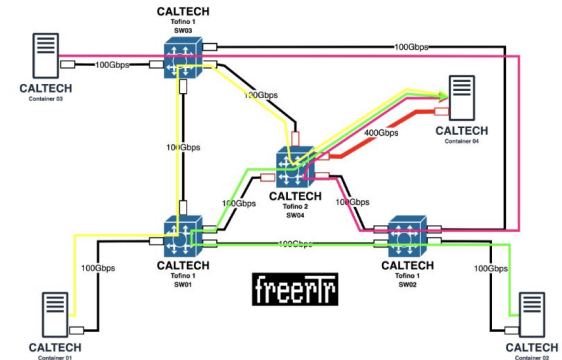
PolKA routing approach to support traffic engineering for data-intensive science

Magnos Martinello, Rafael Guimarães, Everson Scherrer Borges, Cristina Dominicini,
Diego Maffioletti, Jordi Ros-Giralt, Edgar Pontes, Moisés Ribeiro and Harvey Newman

This NRE proposes to demonstrate PolKA functionality to support the TE challenges for data-intensive science.


PolKA is a novel source routing approach [1] that explores the Residue Number System (RNS) and Chinese Remainder Theorem (CRT) by performing the forwarding as an arithmetic operation: the remainder of division. PolKA encodes the path in a routeID using the RNS in contrast to the conventional list-based representation, which transports the path information “in clear” inside the packet header. Then, PolKA core nodes use this encoded route label to discover the output ports.

We plan to divide the demonstration of PolKA capabilities into two scenarios: i) in a data-intensive transfer over 100G and 400G network by using PolKA underlay tunnels; ii) in a comparison between segment routing and PolKA over a high-speed intercontinental testbed composed of P4-enabled programmable switches that interconnect DIS research facilities (Europe, South, and North America) employing its controllability of flows to support TE. The flows can be classified, balanced, and steered at the edge using a Policy-Based Routing (PBR) so that TE decisions can be guided by the Quantitative Theory of Bottleneck Structures (QTBS) and GradientGraph (G2)[3] for optimization.



RARE/freeRtr community support

- **Community channels**

- Mailing list
 - **rare-users, rare-dev @lists.geant.org**
- RARE messaging
 - IRC #freertr@DN42
 -  rare_freerouter

- **Dissemination**

- Liaison with international WG (GNA-G, APAN, LHC, UbuntuNet alliance etc.)
- Conferences
 - SC23/24, IETF hackathon, TNC, APAN, RIPE etc.
- **Would you like to host a RARE/GP4L Workshop?**



Thank You!

Any question or comment? Please contact us at
netdev@lists.geant.org

www.geant.org



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