

GÉANT Project Symposium 2023

MONTPELLIER, FRANCE

12 - 14 December

symposium.geant.org



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GÉANT Project Symposium 2023



Network Developments Update

December 13 2023

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WP6

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WP6 - Network Development Work Areas

GÉANT Project Symposium 2023

Network Development

- Optical Time and Frequency Ne
- Quantum Technologies - QT
- Router for Academia, Research
- GÉANT P4 Lab - GP4L

Production Services

- Service Provider Architecture (SPA)
- Network Management as a Service (NMaaS)
- perfSONAR
- PMP
- TimeMap
- Argus
- WiFiMon
- Network eAcademy

GÉANT Project Symposium 2023

NETDEV Incubator

Network Development

- Optical Time and Frequency Networks - OTFN
- Quantum Technologies - QT
- Router for Academia, Research and Education - RARE
- GÉANT P4 Lab - GP4L

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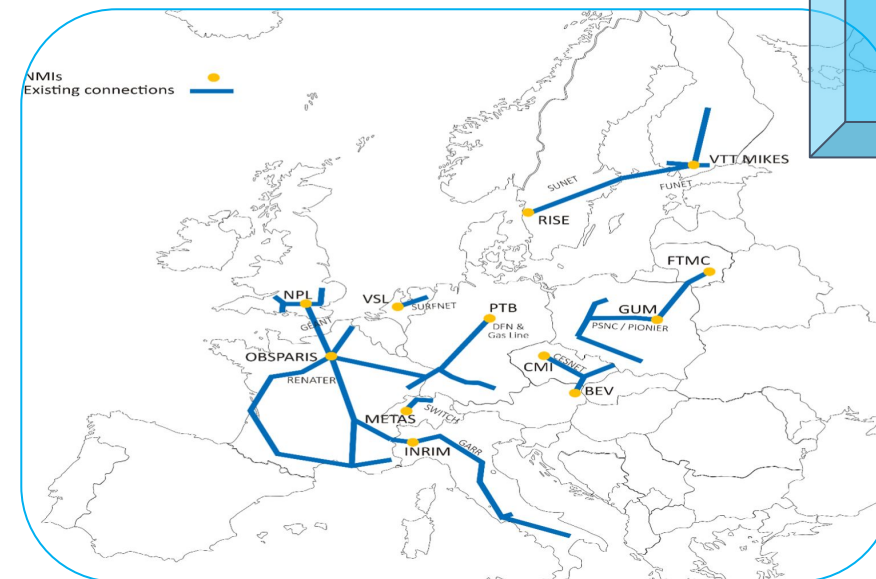
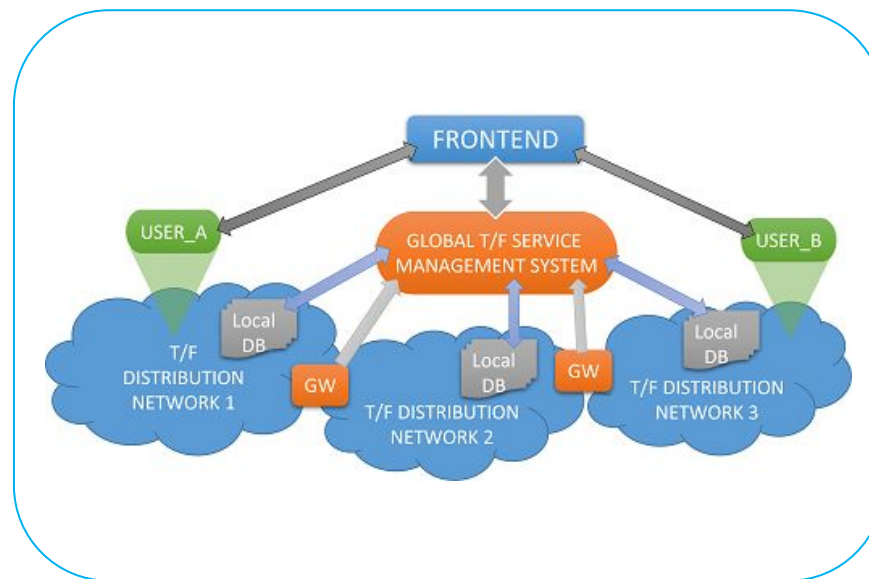
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Optical Time and Frequency Networks - OTFN

Exploring approaches for Time and Frequency (T&F) Services in NREN Networks:

- Building upon already existing T&F infrastructure and services
- T&F Gateway - national signal sources and cross-border transfer
- Monitoring and calibration solutions

OTFN training material in the Network eAcademy



<https://wiki.geant.org/display/NETDEV/OTFN>

Quantum Technologies

Exploring Quantum Technologies (QT) for NREN Use cases

Supporting NRENs in their QT deployments and EuroQCI project

- Open Quantum Group meetings and infoshares
- Knowledge hub on the [QT wiki](https://wiki.geant.org/display/NETDEV/QT)

QT training material in the Network eAcademy



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

rare-users@lists.geant.org

rare-dev@lists.geant.org

rare@lists.geant.org

RARE/freeRtr at MPLS SD
& AI Net World Congress
2023 (Paris)



GP4L - GÉANT P4 Lab

Programmable switch-based lab infrastructure interconnected through the GÉANT network:

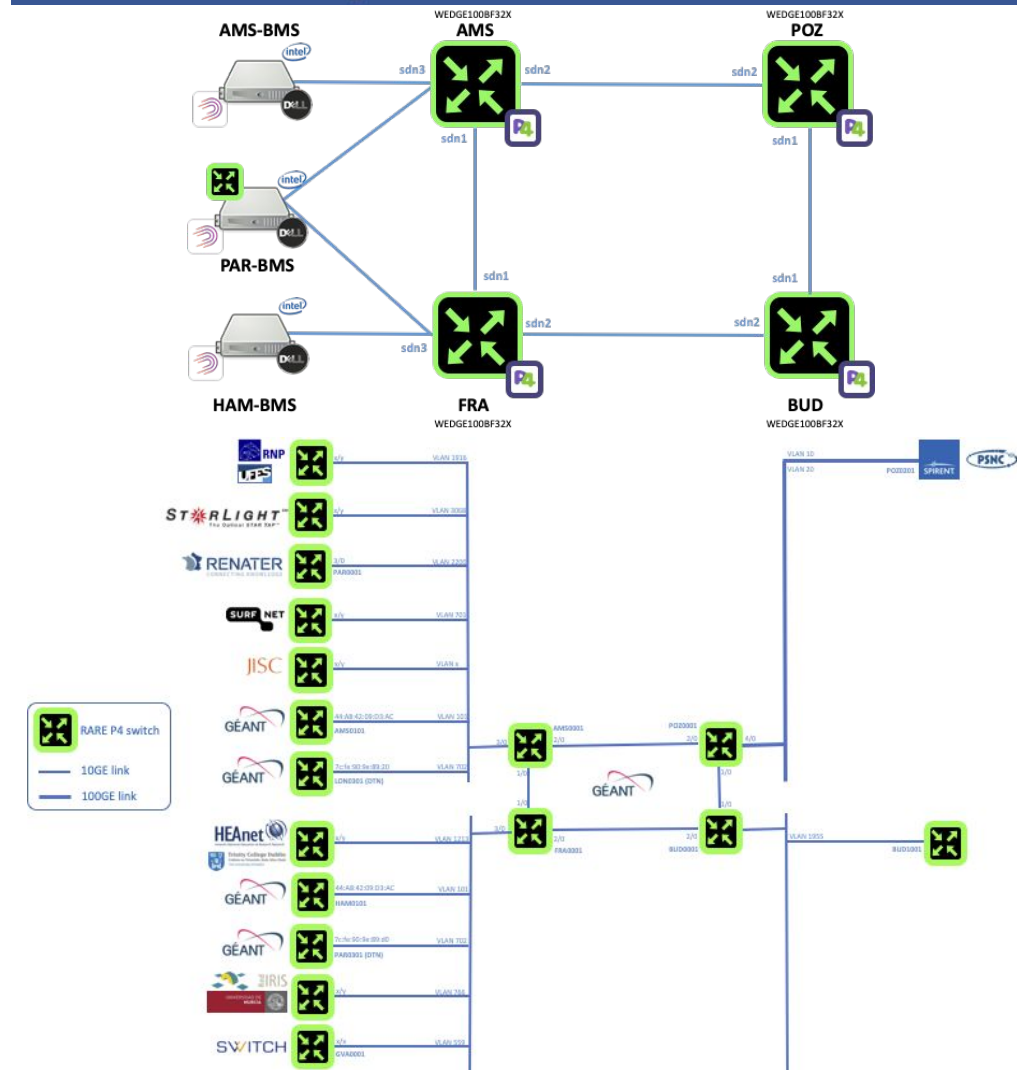
- 40 devices in 26 nodes worldwide (RNP (3), Caltech, Starlight, TENTECH, UoMaryland, AMLight, KISTI, APAN, KAUST...)
- 19 switches in Europe: GÉANT - AMS, POZ, FRA, BUD, GVA, PAR, PRG, SURF, UvA, KIFU, CERN, SWITCH, HEANET, RENATER, TCD, UMU, UPV/EHU, JISC,...

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:

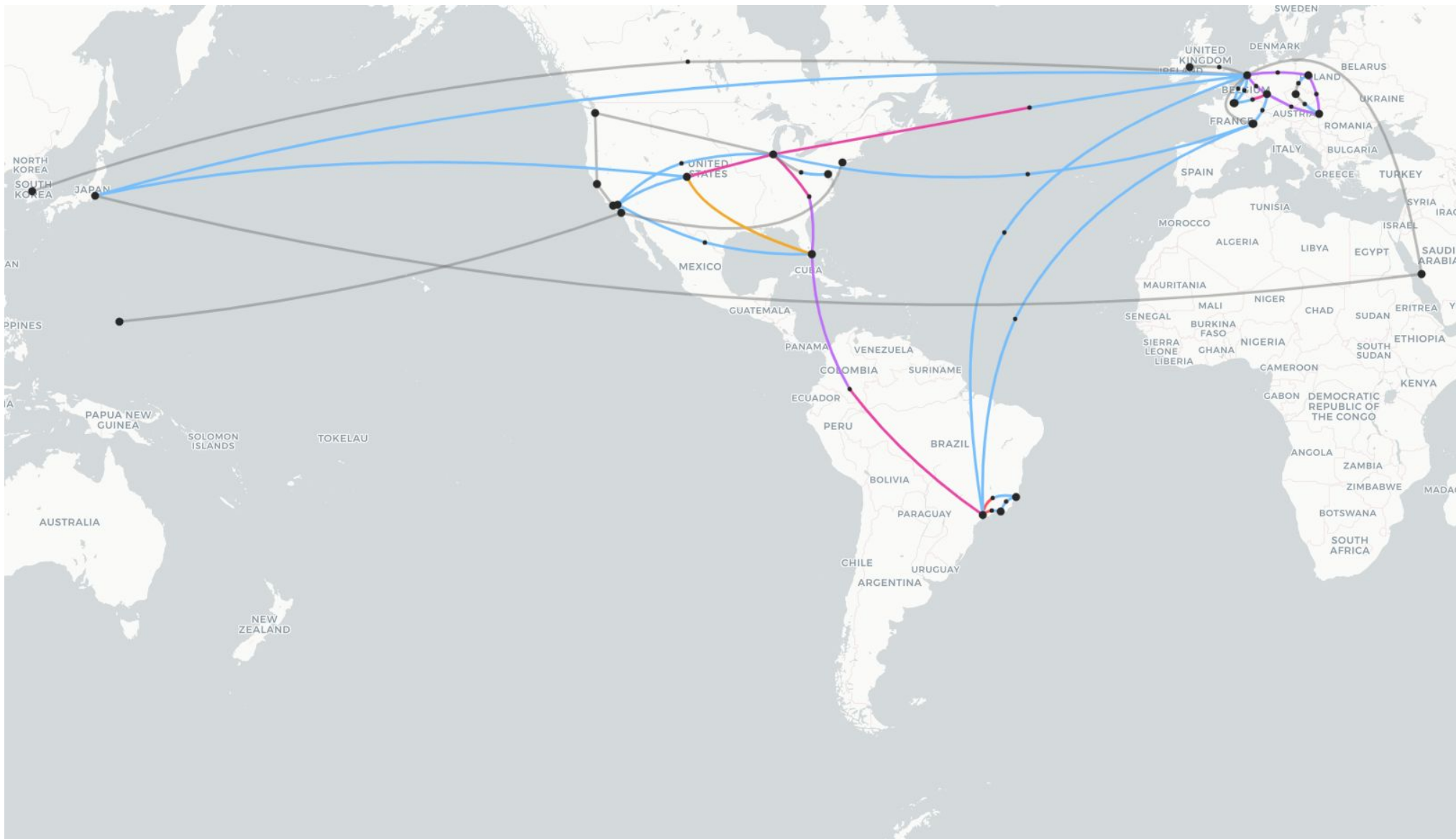
- With the usage of RARE/FreeRtr NOS
- Using a clean slate environment (i.e use exclusively GP4L without RARE/FreeRtr dataplane & control plane)

GP4L GÉANT P4 LAB



<https://wiki.geant.org/display/GP4L>

Global P4 Lab (November 2023)



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Production Services

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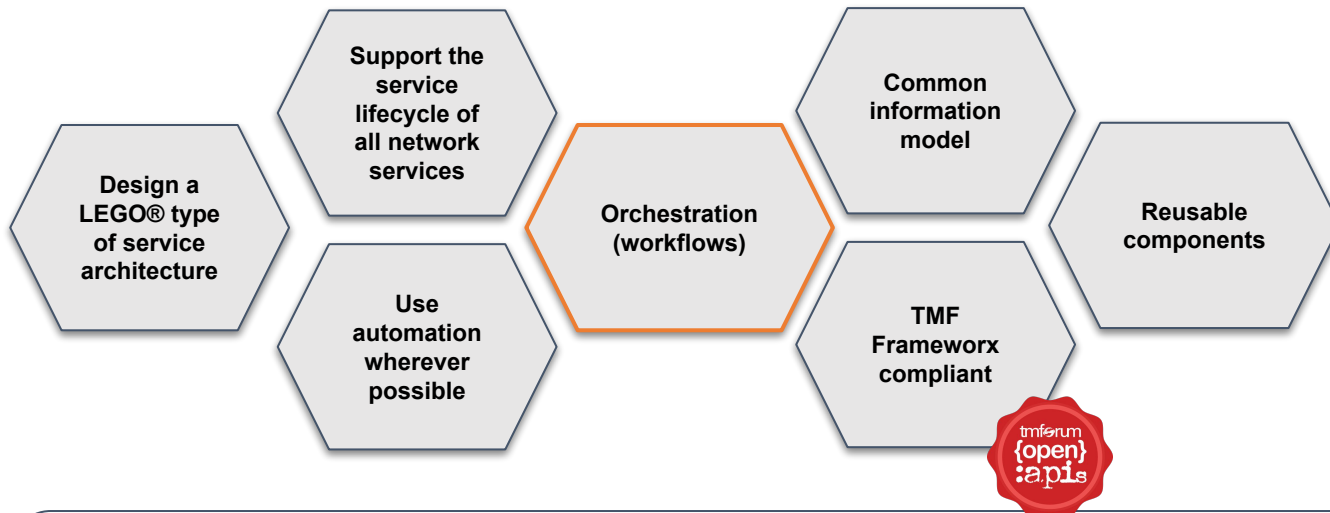


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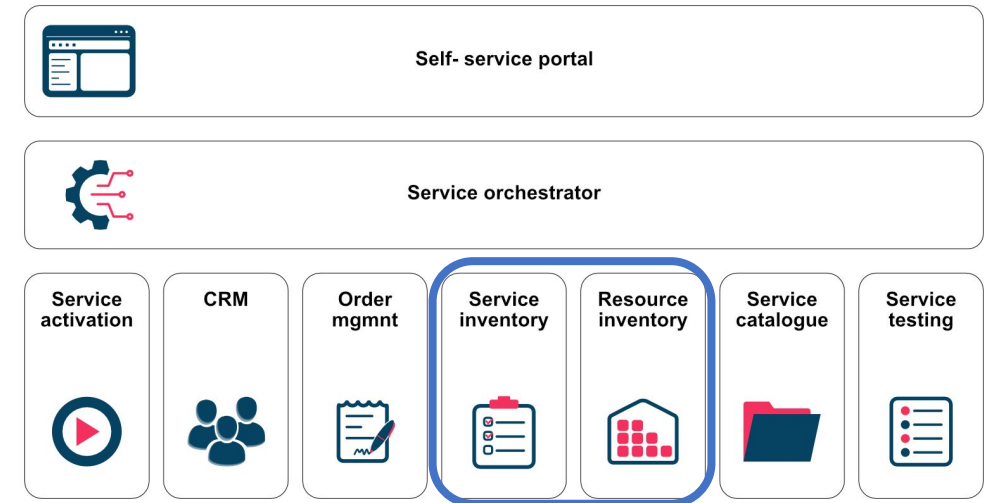
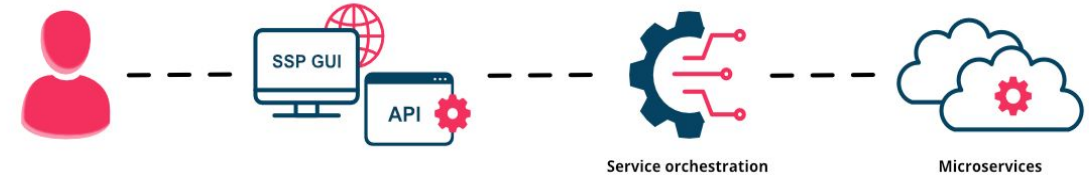


SPA Service Provider Architecture

SPA is a modular distributed platform to orchestrate and automate network services in the GÉANT and NREN network infrastructures.



- Process- and service orchestration and automation in action
- Used for the GÉANT Connection Service (GCS)
- In the process of decommissioning



spa@lists.geant.org
<https://wiki.geant.org/display/NETDEV/SPA>

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:

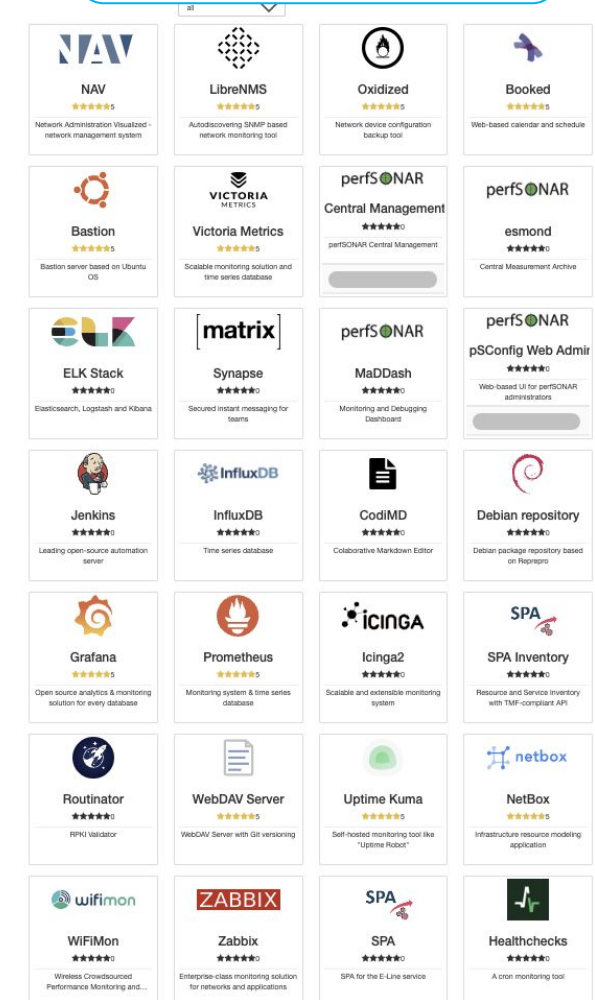
- Network/Equipment Management for Small/Medium size networks/institutions
- Project-owned equipment
- NMaaS Virtual Lab - **NEW!**

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

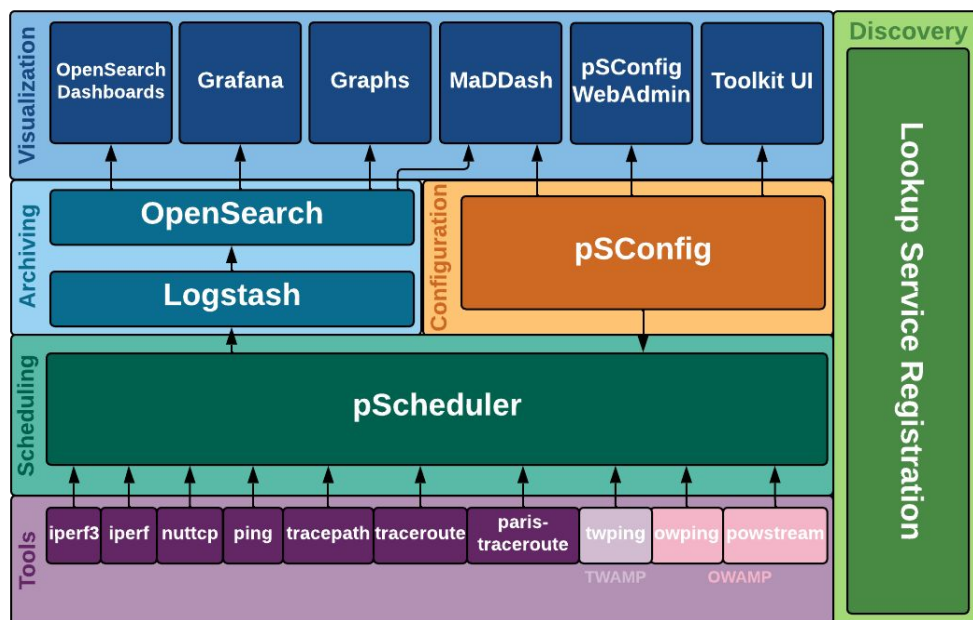


perfSONAR

Open-source, modular, flexible architecture for IPv4 and IPv6 active network measurement and monitoring

Some GÉANT's recent contributions:

- Lookup Service dashboards
- Microdep integration with perfSONAR
- On-demand perfSONAR Graphical User Interface (psGUI)



Over 2000 registered hosts in more than 1000 organisations around the world

Supported on **Ubuntu 20**
 More OSs to follow in early summer
 (EL8, EL9, Ubuntu 22, Debian 11)

Performance Measurement Platform - PMP

Exploring the performance of the GÉANT backbone while experiencing perfSONAR on small nodes

- Low-cost hardware nodes with pre-installed perfSONAR software and deployed in GÉANT collaborating organisations in Europe and Africa.
- Central components including a central Measurement Archive (MA) and a Dashboard.
- Measurement points in the GÉANT backbone network (and few in Africa)
- PMP service coverage in Europe - 34 NRENs
- PMP data analysis for new service report using AI/ML

Dashboard: <https://pmp-central.geant.org/maddash-webui/>

Contact: perfsonar-smallnodes@lists.geant.org



	GEANT	Google	RPIE	Wikipedia
Albania - pfs.rash.al	Green	Green	Green	Green
Armenia - perfsonar.asnet.am	Green	Green	Green	Green
Austria - ps02.aco.net	Green	Green	Green	Green
Belarus - psmall-g-1.basnet.by	Green	Green	Green	Green
Belgium - perfsonar.r2.brudie.belnet.net	Black	Black	Black	Black
Croatia - psmall.st.carnet.hr	Green	Green	Green	Green
Cyprus - perfsonar.cynet.ac.cy	Green	Green	Green	Green
Czech Republic - perfsonar.cesnet.cz	Black	Black	Black	Black
Denmark - pssmall.grid.aau.dk	Green	Green	Green	Green
Estonia - pmpvirt-tar.eenet.ee	Green	Green	Green	Green
France - paris1-snd-022.perfsonar.renater.fr	Black	Black	Black	Black
France - perfsonar.icm-institute.org	Black	Black	Black	Black
Georgia - perfsonar.grena.ge	Green	Green	Green	Green
Germany - psmall-test.x-win.dfn.de	Black	Black	Black	Black
Germany RPI - psbrix.rrze.uni-erlangen.de	Green	Green	Green	Green
Ghana - perfsonar.garnet.edu.gh	Green	Green	Green	Green
Greece - perfsonar-node.gnet.gr	Green	Green	Green	Green
Hungary - perfsonar.debrecen3.hbone.hu	Green	Green	Green	Green
Ireland - bob.heanet.ie	Green	Green	Green	Green
Italy - geantsonar.units.it	Green	Green	Green	Green
Italy - lola01.garr.it	Green	Green	Green	Green
Latvia - perfsonar.lumii.lv	Green	Green	Green	Green
Lithuania - perfsonar.vgtu.lt	Green	Green	Green	Green
Luxembourg - perfsonar.restena.lu	Green	Green	Green	Green
Moldova - node1.perfsonar.renam.md	Green	Green	Green	Green
Montenegro - snps-mren.ac.me	Black	Black	Black	Black
Netherlands - ams-ps-small.netherlight.net	Green	Green	Green	Green
Nigeria - 154.68.224.57	Black	Black	Black	Black
Poland - psmall-poz1.man.poznan.pl	Green	Green	Green	Green
Portugal - psmall-lis.net.fccn.pt	Black	Black	Black	Black
Romania - pSmall.roedu.net	Green	Green	Green	Green
Senegal - perfsonar.ucad.sn	Green	Green	Green	Green
Serbia - ps-small.amres.ac.rs	Green	Green	Green	Green
Slovenia - mp-tpl-pfgeant.arnes.si	Green	Green	Green	Green
Spain - perfsonar-sonda.rediris.es	Green	Green	Green	Green
Spain - pspmp-anella.csuc.cat	Green	Green	Green	Green
Turkey - perfsonar-ankara.ulakbim.gov.tr	Green	Green	Green	Green
Ukraine - pmp-kyiv.uran.ua	Black	Black	Black	Black
United Kingdom - perfsonar.qub.ac.uk	Black	Black	Black	Black
United Kingdom - ps-small-slough.ja.net	Green	Green	Green	Green
United Kingdom - psmall.lut.ac.uk	Green	Green	Green	Green

TimeMap

Per-segment latency and jitter monitoring tool

Based on TWAMP (RFC 5357)

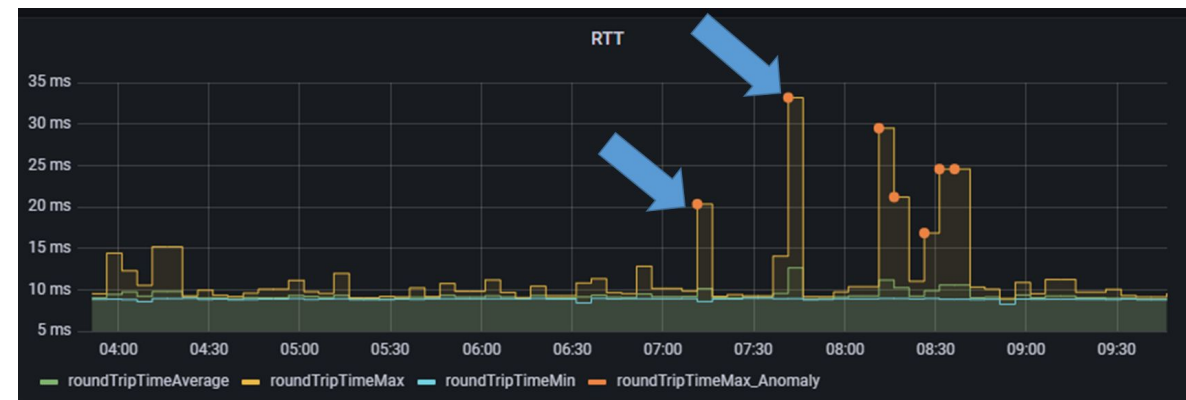
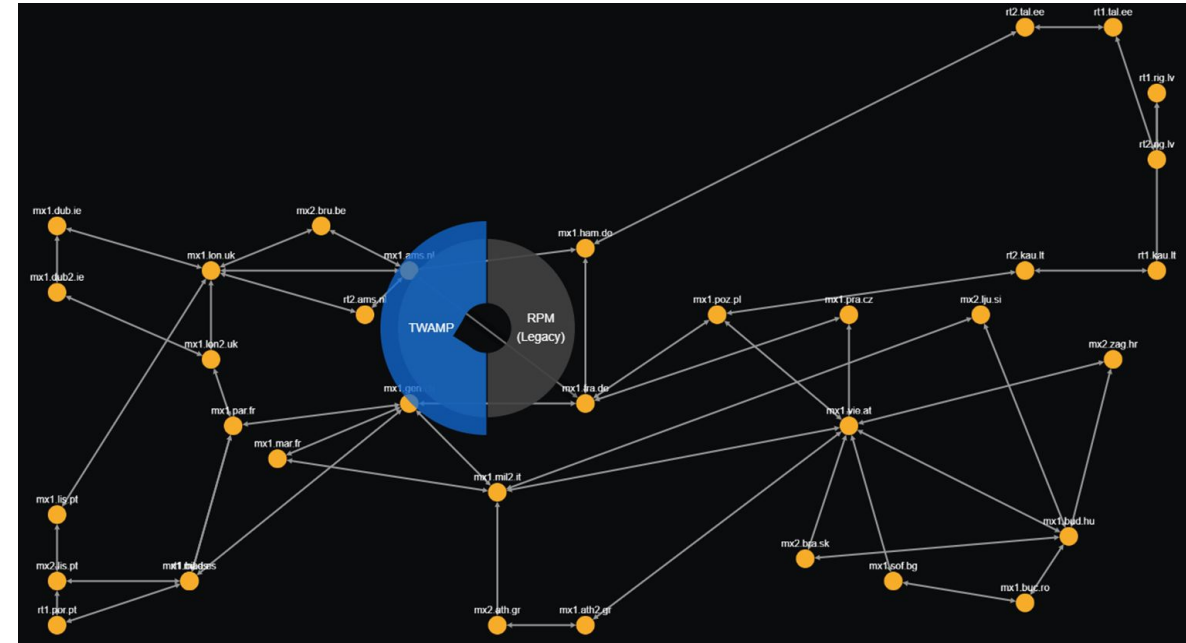
Easy and quick modular installation

Initial AI-based anomaly detection implemented

Deployed in the [GÉANT backbone network](#)

Documentation

- [TimeMap](#)
- [Code and documentation](#)
- [TimeMap page](#)





An alarm aggregation and correlation tool

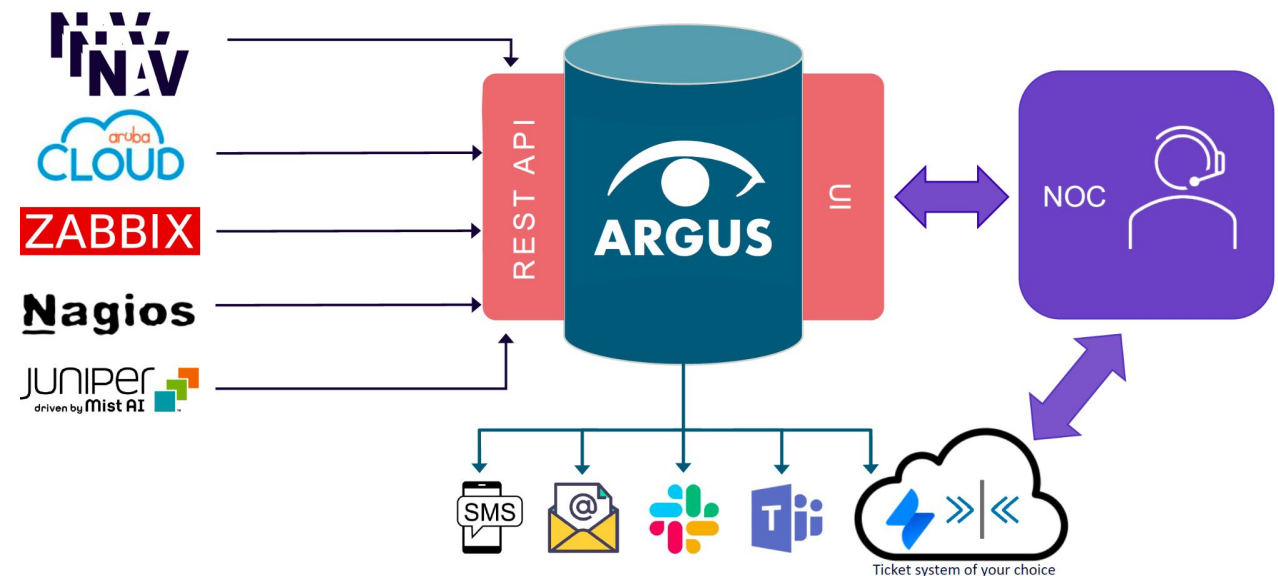
- A single unified dashboard and notification system for aggregated incidents from all monitoring applications
- Based on the CNaas use case
- In production in Sikt and SUNET
- A production service since Sept 2022

<https://wiki.geant.org/display/netdev/argus>

The screenshot shows the ARGUS web interface with the following components:

- Navigation:** INCIDENTS, TIMESLOTS, PROFILES, NOC.
- Filters:** Open State (OPEN, CLOSED, BOTH), Acked (ACKED, UNACKED, BOTH), Sources (Source name), Tags (service=Campus_CNaaS, key=value), Max level (5 - Information).
- Table of Incidents:**

Timestamp	Status	Severity level	Source	Description	Actions
2022-04-28 09:56	Open Non-acked	3 - Moderate	nav.customer1.example.org	box down example-sw.customer1 192.168.42.42	[Action]
2022-04-27 11:42	Open Non-acked	4 - Low	mobility-master.example.org	AP down: AP1553 at somecollege	[Action]
2022-04-02 13:12	Open Acked	1 - Critical	nav.customer1.example.org	box down main-gsw.customer1 192.168.0.1	[Action]
2022-04-02 09:32	Open Acked	3 - Moderate	nav.someschool.example.org	nav.devices.hologhonor-sw1_someschool.sensors.xe-1_2_2_jnxDomCurrentFlxLaserPower exceeded at -37.32 <-14	[Action]
2022-04-02 08:32	Open Acked	2 - High	zabbix.example.org	slurm.example.org: Software RAID: Device md0 is active.degraded	[Action]
- Footer:** Last refreshed 2022-05-03 15:35:50 updating every 30. Backend v.1.5.1.dev1+g18faa05, API v1(stable), frontend v.1.5.4.



WiFiMon

A WiFi network monitoring and performance verification system

WiFiMon is a WiFi network monitoring and performance verification system. It is capable of detecting performance issues, visualising the achievable throughput of a wireless network for each user, and providing technical information about a WiFi network (e.g., signal strength, link quality, bit rate, etc.). **WiFiMon** leverages well-known performance verification tools (e.g., Akamai **Boomerang** and **Speedtest**) and in addition uses data from the WiFi physical layer in order to gather a comprehensive set of WiFi network performance metrics.

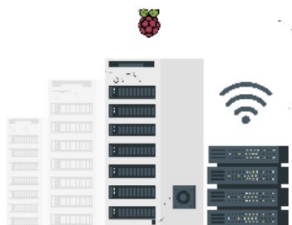
WiFiMon Operation Modes

WiFiMon can operate in two different modes which can be used either separately or together

Software Crowdsourced Measurements



Hardware Probe Measurements



WiFiMon



wifimon

Technology and vendor agnostic



WiFiMon can be deployed on any WiFi network as it monitors the performance on the network layer. It can also provide additional benefits in 802.1x enabled networks including **eduroam** in which case users can make various performance analyses per access point, per user, etc.

Easy to deploy



WiFiMon is a software image (also available as a Docker Image) and can be easily deployed on an NREN/University network on hardware or software probes.

Fine grained information on network performance



WiFiMon shows the end-user (mobile client) behaviour on a network, its perception about the responsiveness of the network and the speed of web resource downloads, correlation of the performance data with end-user data, and data analysis with an effective query builder.

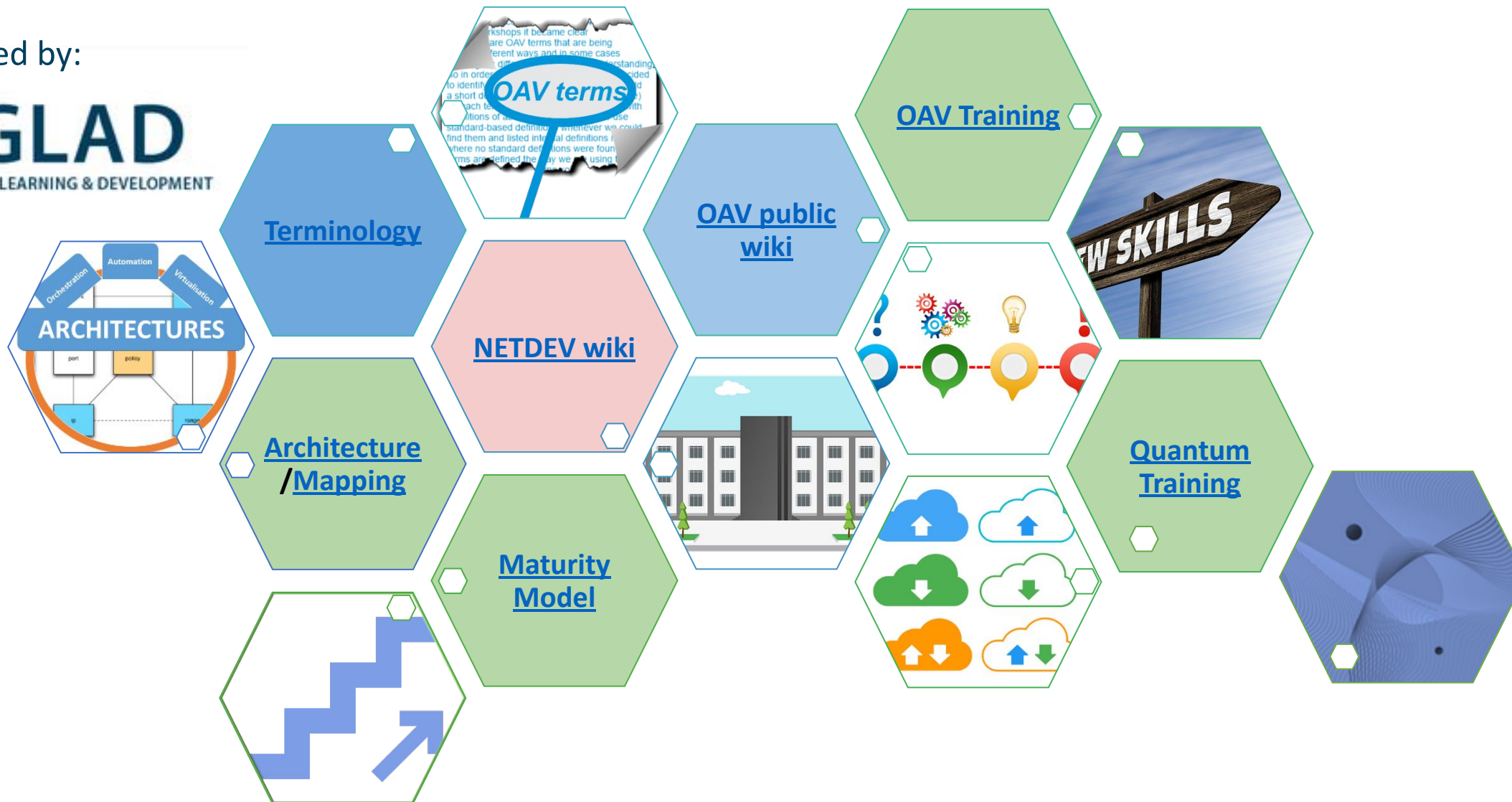
Active monitoring with low network overhead



WiFiMon active measurements are not significantly invasive and do not use any significant bandwidth. One **WiFiMon** measurement is comparable to one average web-page download (load speed).

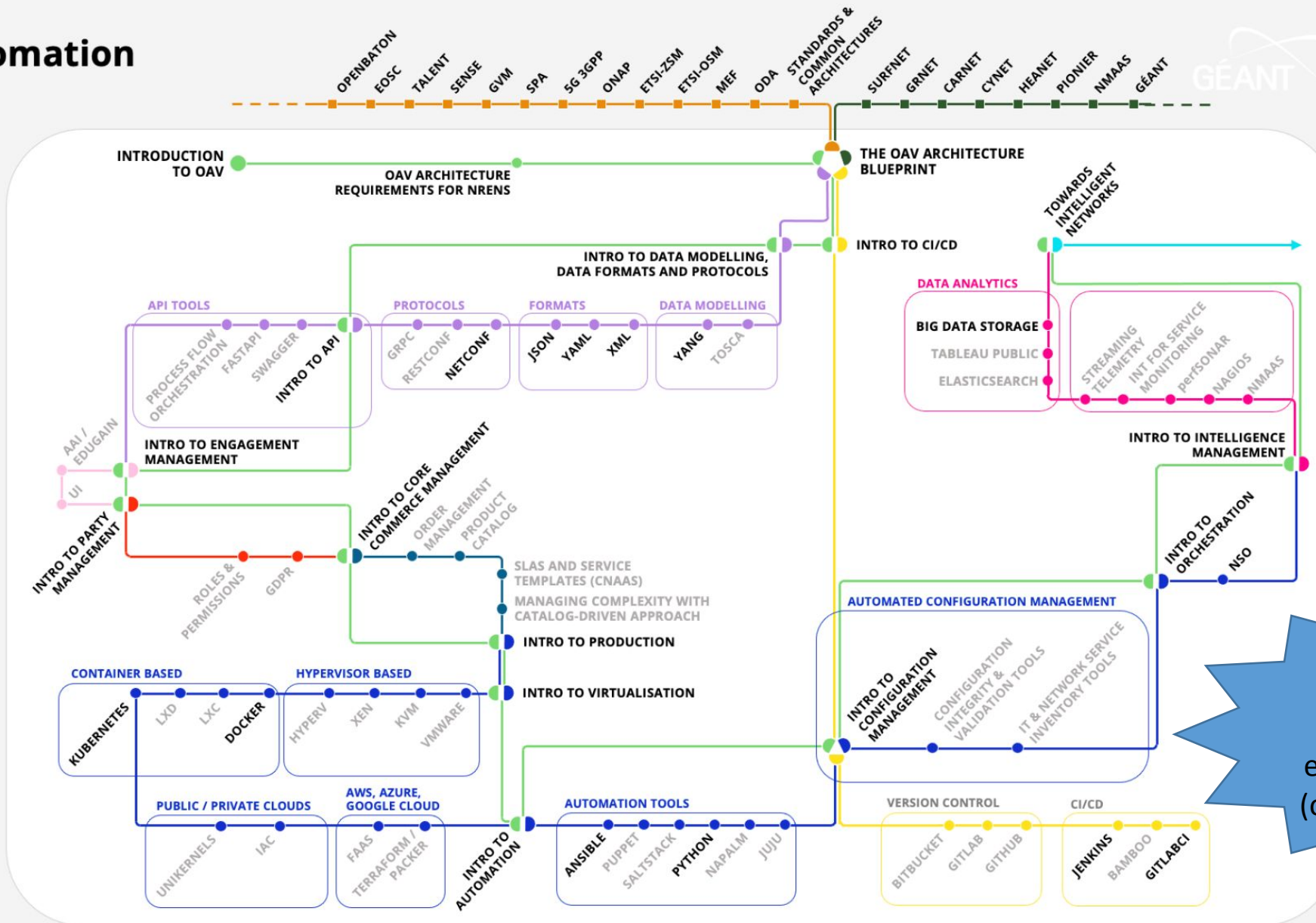
Network eAcademy

Powered by:



Network Automation eAcademy

Functional Blocks in the TM Forum OPEN DIGITAL ARCHITECTURE (ODA)



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eduGAIN access
(or social media)

Quantum Technologies eAcademy

Available courses



Quantum Technology eAcademy
QUANTUM ALGEBRA: QuBits
Introduction

Quantum Algebra: QuBits

Category: **Quantum Technology**

Course creator: Peter Kaufmann



Quantum Technology eAcademy
QUANTUM ALGEBRA: OPERATOR MULTIPLICATION: VARIANTS
Introduction

Quantum Algebra: Operator Multiplication: Variants

Category: **Quantum Technology**

Course creator: Peter Kaufmann



More learning units in preparation

<https://e-academy.geant.org/moodle/course/index.php?categoryid=54>

OAV Terminology

Terminology and Glossary of terms related to:

- Orchestration, Automation and Virtualisation
- Maturity Model
- Artificial Intelligence

Motivation:

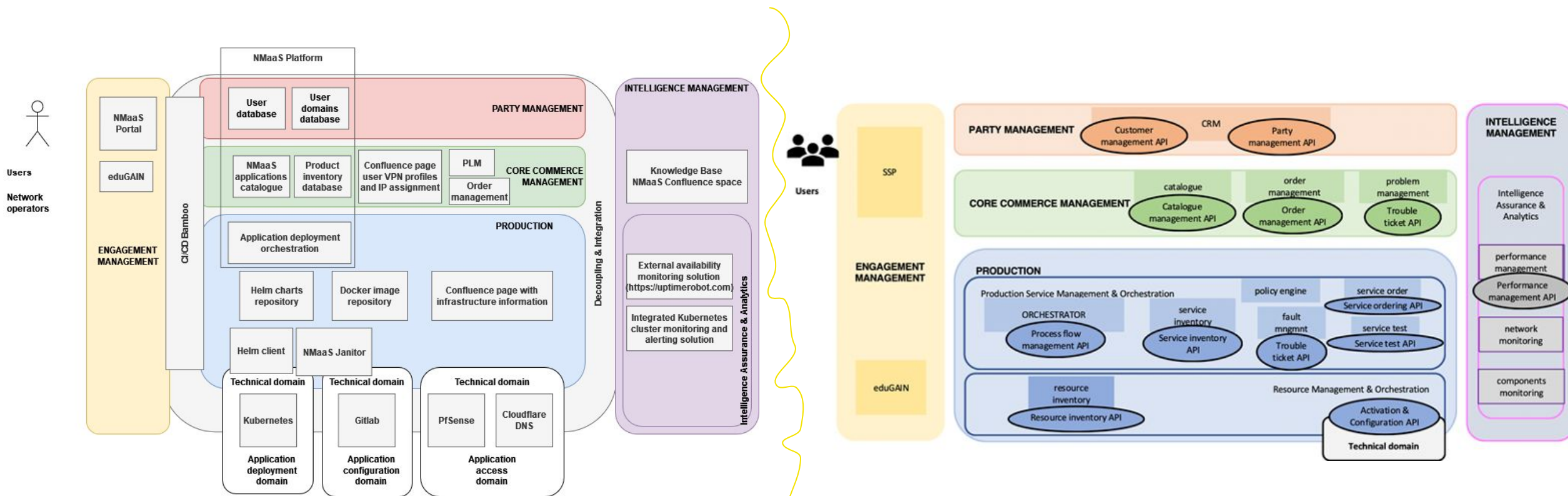
- To bridge the terminology gap in the community
- To systematically structure relevant OAV, AI and MM terminology

Published in collaboration with the GNA-G Automation Working Group

[OAV Terminology Document](#)



Architecture mapping - NMaaS and SPA cases



Digital Architecture Analysis

Mapping NREN & use cases architectures to a common blueprint, the TM Forum Open Digital Architecture (functional architecture).

Align efforts

Find similarities

Collaboration

Interoperability

NREN Architectures

- [CARNET](#)
- [CYNET](#)
- [GÉANT](#)
- [GRNET](#)
- [HEAnet](#)
- [PIONIER](#)
- [SURF](#)

NETDEV Architectures

- [Argus](#)
- [NMaaS](#)
- [SPA](#)

Other Use Cases

- [5G](#)
- [EOSC](#)
- [ETSI GANA](#)
- [ETSI OSM](#)
- [ETSI ZSM](#)
- [GVM](#)
- [MEF LSO](#)
- [Open Baton](#)
- [ONAP](#)
- [SENSE](#)
- [TALENT](#)

Maturity Model for Orchestration, Automation and Virtualisation (OAV)

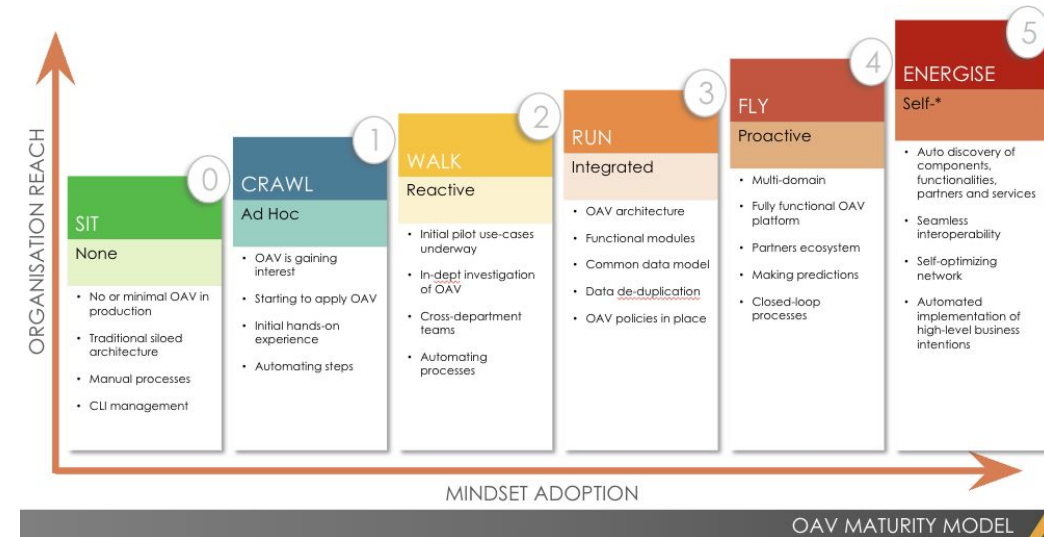
A self-assessment tool as a digital transformation progress indicator:

- 31 questions
- Data is used for analytical purposes only
- Report is sent to the person defined in survey
- Individual responses not published

OAV Maturity model white paper, published on November 7th:

<https://resources.geant.org/wp-content/uploads/2023/11/GN5-1>

[White-Paper_OAV-Maturity-Model.pdf](#)



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NETDEV Incubator

A mechanism to **include new work during the project**, but
Not the only place where a new work is happening.

Why

- Projects are long, with the preparation phase even more:
- Difficult to anticipate tech development in 3-4 years
 - New needs or ideas appear during the project

How

- Unallocated budget set aside in WP6 T4
- By following predefined simple rules
- Open not only for WP6 members

What

- WP6-related topics on Network Development
- Projects whose results NRENs want to use
- Projects with the outcome

NETDEV Incubator

NETDEV Incubator is designed to be an **agile** process to include new areas of work throughout the project duration

- **Easy and transparent 3-step**
- Proposals can be sent at any time during the project
- No formal/paper proposal submission
- Evidenced community **interest to use the results**
- Create a team, make a proposal and if within scope, you can start in less than one month after submission



Proposals Submission

- **Always open call for proposals**

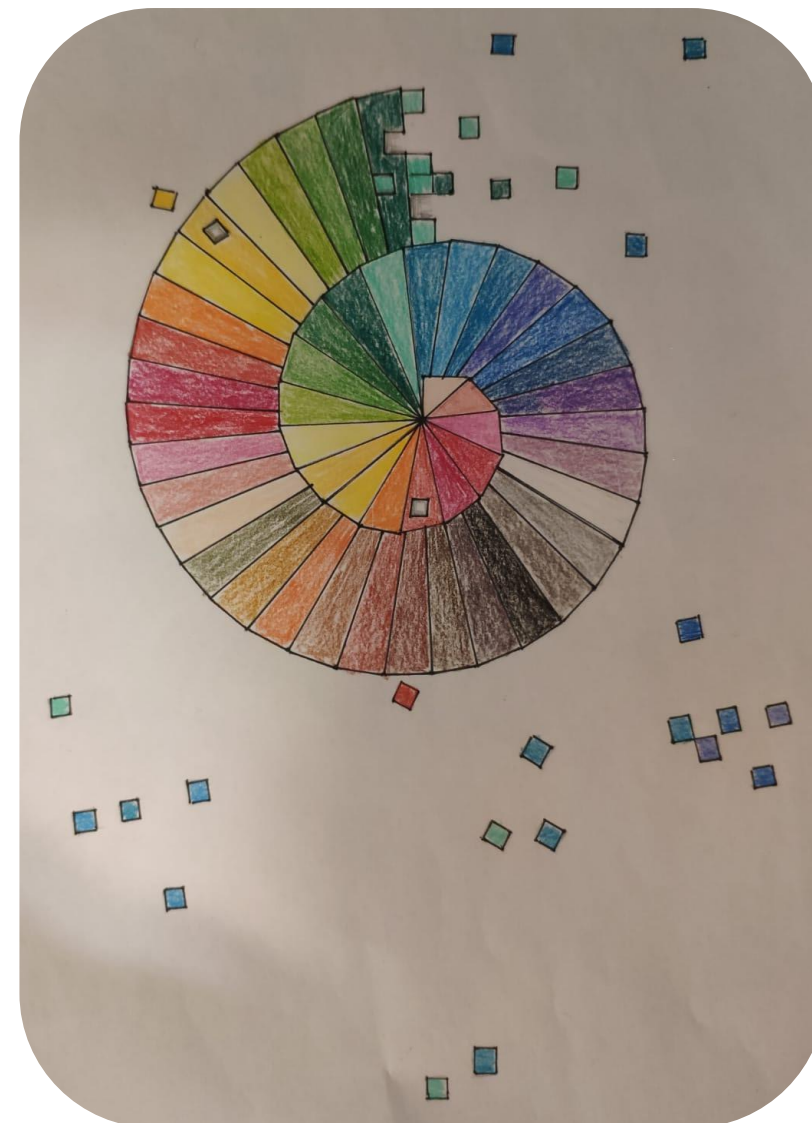
Anyone can make a proposal any time

- Email-based proposal submission using **predefined template**

- **Community support is a prerequisite!**

Support = willingness to **use** the Project results

Support from at least **3** project partner organisations is a **prerequisite** for a proposal **to be considered for the next phase**



Important links



Contact emails:

- NETDEV Incubator team: netdev-incubator@lists.geant.org
- NETDEV (WP6) team: netdev@lists.geant.org

Wiki pages:

- NETDEV Incubator: <https://wiki.geant.org/display/NETDEV/NETDEV+Incubator>
- NETDEV Home: <https://wiki.geant.org/display/NETDEV/>

Forthcoming Events

Tomorrow

- Lightning talks about **Argus** and **NMaaS Virtual Labs**
- **Network Infrastructure and Services Roadmap** - WP6 and WP7 plans for the future

January

- 18th GÉANT Infoshare - NETDEV Incubator - please register:
 - <https://events.geant.org/event/1587/>
- 31st Infoshare: PTP operational issues - please register:
 - <https://events.geant.org/event/1581/>

February

- 14th - Network Performance and Monitoring - please register:
 - <https://events.geant.org/event/1588/>

After that

- More to come - look at the GÉANT events page

Thank you

Any questions

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