Network Development in the GÉANT Project

Maria Isabel Gandia Carriedo, CSUC/RedIRIS

Ivana Golub, PSNC

TNC23

June 5-9, Tirana, Albania

Agenda

- Environment
- Network Development
- Production Services
- NETDEV Incubator

The GÉANT Project Structure

WP1 Project Management	WP2 Marcomms, Events and Policy Engagement	WP3 User and Stakeholder Engagement	WP4 Above-the-Net-Services	WP5 Trust & Identity Services Evolution and Delivery	WP6 Network Development	WP7 Network Core Infrastructure and Core Service Evolution and Operations	WP8 Security	WP9 Operations Support
Task 1: Project Governance, Management & Coordination	Task 1: Communications and Design	Task 1: Partner Relations	Task 1: User-Facing Service Delivery Chain	Task 1: Operations and Enhancement of eduroam	Task 1: Technology	Task 1: Network Engineering and Implementation	Task 1: Security Management	Task 1: Operations Centre including CERT
Task 2: Finance	Task 2: Services Marketing	Task 2: Supporting International User Groups	Task 2: Vendor-Facing Service Delivery Chain	Task 2: Operations and Enhancement of eduGAIN	Task 2: Platform	Task 2: Network Infrastructure and Services Evolution	Task 2: Human Factor	Task 2: Software Governance and Support
Task 3: ICT	Task 3: Events	Task 3: External Relationships	Task 3: Infrastructure Cloud Procurement	Task 3: AAI Core platform and eduTEAMS Services	Task 3: Monitoring	Task 3: Network Management, Automation and Orchestration	Task 3: Security Products and Services	Task 3: Service Management
Task 4: PLM	Task 4: Policy Engagement	Task 4: Community Programme	Task 4: Above Net Services Strategic Planning	Task 4: InAcademia	Task 4: Academy	Task 4: Packet Layer Renewal	Task 4: Research; Security for High-Speed Networks	Task 4: GÉANT Software Development and Operations
Task 5: Human Capital Development			Task 5: Above Net Services Developments	Task 5: T&I Incubator	NETDEV			
Task 6: Procurement & Supplier Management				Task 6: T&I Enabling Communities				
				Task 7: Distributed Identities				

WP Leaders: **Ivana Golub (PSNC), Pavle Vuletić (UoB/AMRES)**
WP6 budget: > 3,1 mil EUR
31 R&E organisations from 25 countries
85 team members
https://wiki.geant.org/display/netdev

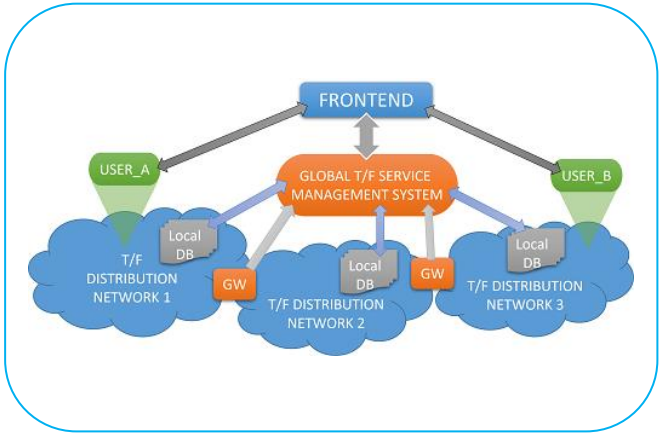
Network Development

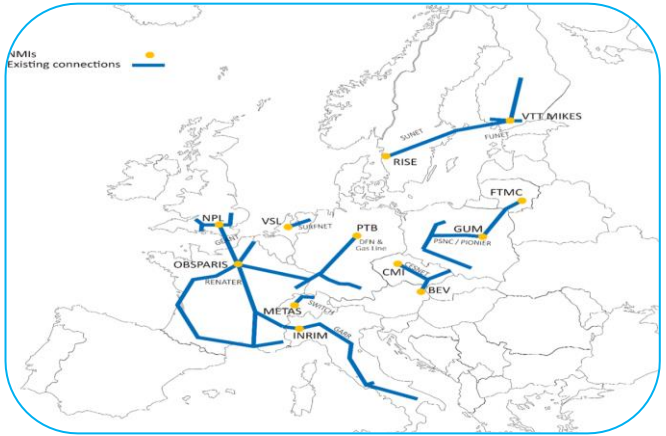
- Optical Time and Frequency Networks - OTFN
- Quantum Technologies - QT
- Router for Academia, Research and Education - RARE
- GÉANT P4 Lab - GP4L
- TechLab

Optical Time and Frequency Networks - OTFN

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

- T&F service and infrastructure study - considering CLONETS-DS results
- T&F Gateway - national signal sources and cross-border transfer
- Monitoring and calibration solutions





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

Quantum Technologies

Exploring Quantum Technologies (QT) for NREN Use cases

- Quantum / QKD services in NRENs

Supporting NRENs in their QT deployments

- QT training material in the Network eAcademy
- Discussion forums:
  - Open Quantum Group Meeting
  - quantum-discuss@lists.geant.org
- QT wiki

Infoshare "Quantum Solutions": 21 June 2023, 1-3pm CEST

https://wiki.geant.org/display/NETDEV/QT

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
Router for Academia Research & Education

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

Complete feature list

Type	Test #	Name	P4		DPDK	XDP
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	✓	✓	✓	✗

GP4L - GÉANT P4Lab

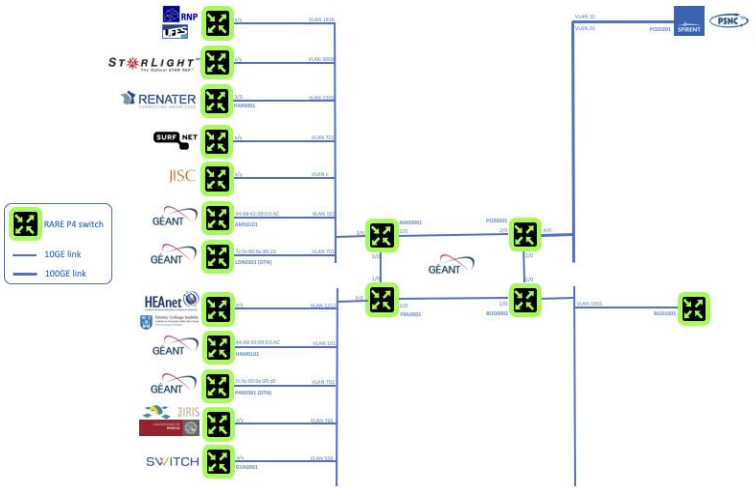
P4 switch-based lab infrastructure interconnected through the GÉANT network

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

Initially aimed **to validate the RARE/FreeRtr** open source routing stack software

With growing interest, 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)



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

Global P4L May 2023

Over **20** locations worldwide

Strong collaboration with the **GNA-G DIS**
GNA-G Data Intensive Sciences Working Group

TechLab

TechLab is an **initiative** to **facilitate access to information** on **research network infrastructures and services** that can be made available to work on **modern and innovative solutions**.

Brings together specialists and researchers **to share knowledge and experience** and promote work results

Offers shared resources and services for advanced testing, piloting and research.

Promotes test infrastructures whose owners are open for collaboration

Increases the visibility of test infrastructures and there developed solutions

[GP4Lab]

[NMaaS]

[perfSONAR in NMaaS]

[SPA/E-Line in NMaaS]

[SPA Inventory2 in NMaaS]

[WiFiMon in NMaaS]

https://wiki.geant.org/display/NETDEV/TechLab

Production Services

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

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:

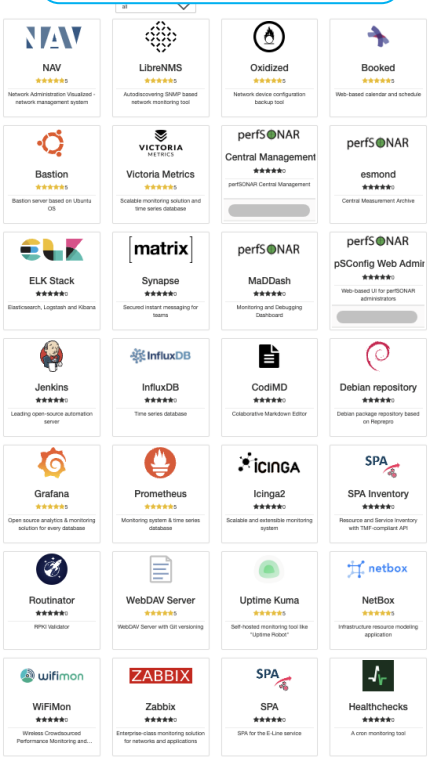
- Network/Equipment Management for Small/Medium size networks/ institutions
- Project-owned equipment
- NMaaS Virtual Lab - **NEW!**

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

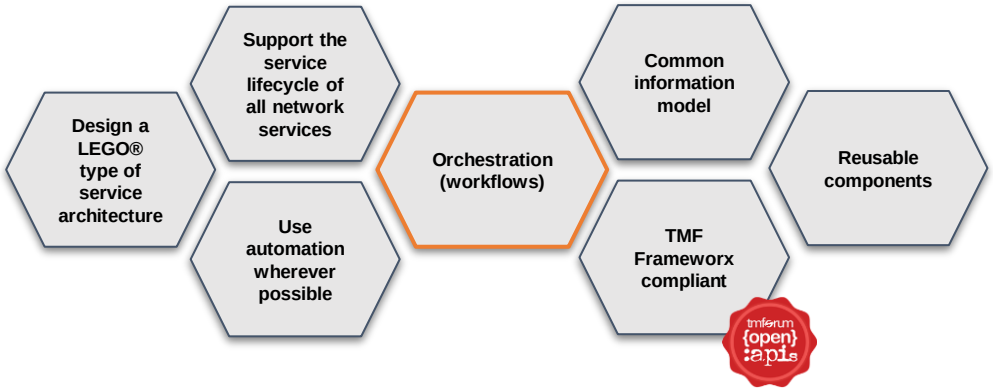
NMaaS

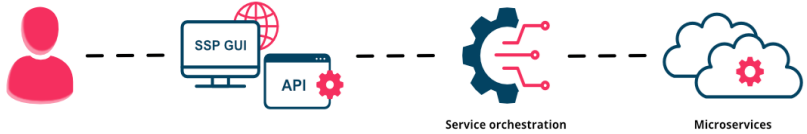
nmaas.eu
nmaas@lists.geant.org

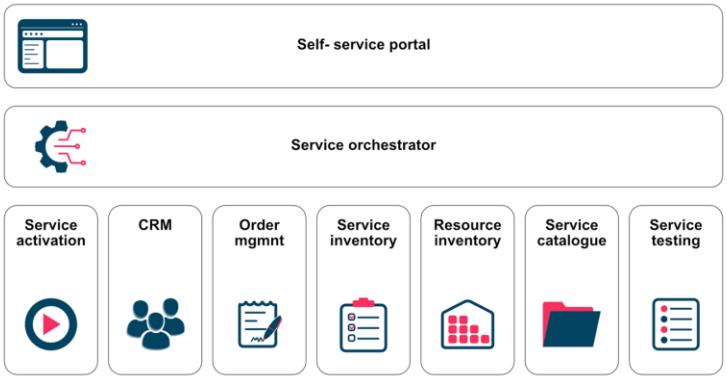


SPA Service Provider Architecture

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







- Used for the GÉANT Connection Service (GCS)
- Test service instance available in NMaaS

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

Inventory

SPA Service Provider Architecture

Resource Inventory and Service Inventory implemented as a stand-alone application

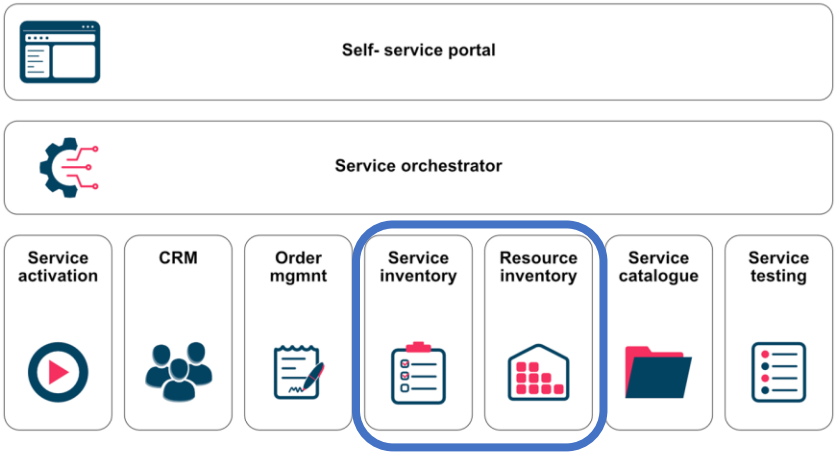
- Storage for the information about resources and service instances

One of the key components of SPA

The Source of Truth for automation

Inventory version **3**

- Use of NoSQL (MongoDB) database
- Data model can be easily updated/ extended and validated
- In testing in PSNC/PIONIER



perfSONAR

ESnet perfSONAR

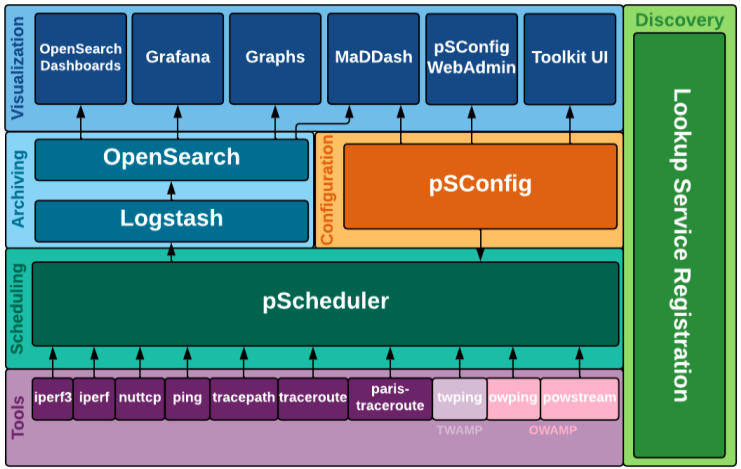
https://www.perfsonar.net/

GÉANT INTERNET2 RNP

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

perfSONAR 5.0 released April 17th, 2023

- Greater visualization and analysis capabilities
- New pScheduler test plugins to support WiFi BSSID, 802.1X authentication, DHCP response time and more



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

- PMP data analysis for new service report using AI/ML
- In green: Countries with the PMP service coverage in Europe

Dashboard: https://pmp-central.geant.org/maddash-webui/
Contact: perfsonar-smallnodes@lists.geant.org

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

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.

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.

Easy to deploy

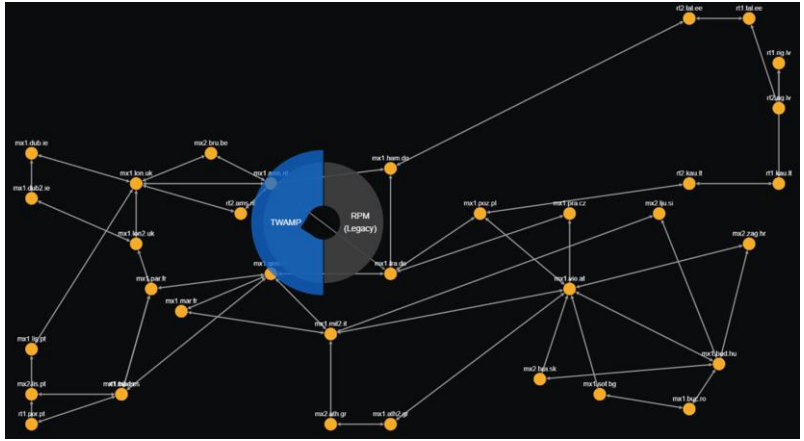
WiFiMon is a software image (also available as a Docker Image) and can be easily deployed on an NREN/University network on hardware or software probes.

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).

TimeMap

Per-segment latency and jitter monitoring tool



Based on TWAMP (RFC 5357)

Easy and quick modular installation

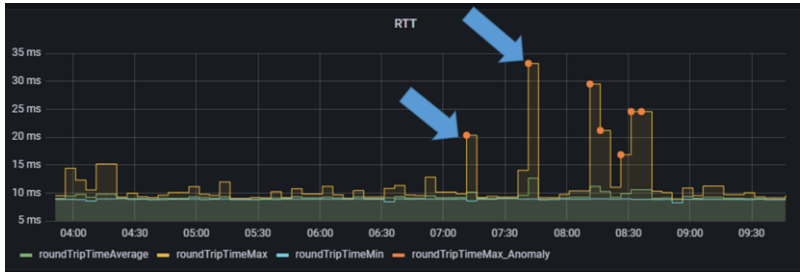
Initial AI-based anomaly detection implemented

Deployed in the GÉANT backbone network

Documentation

- TimeMap
- Code and documentation
- TimeMap page

TimeMap

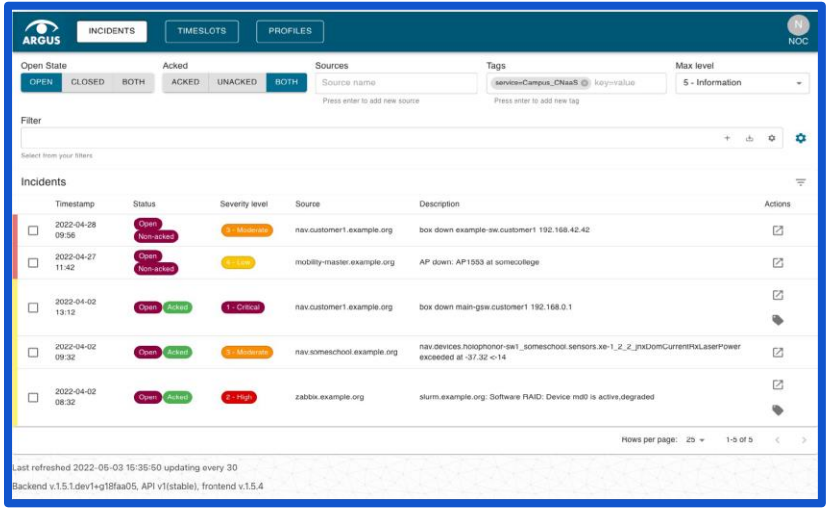


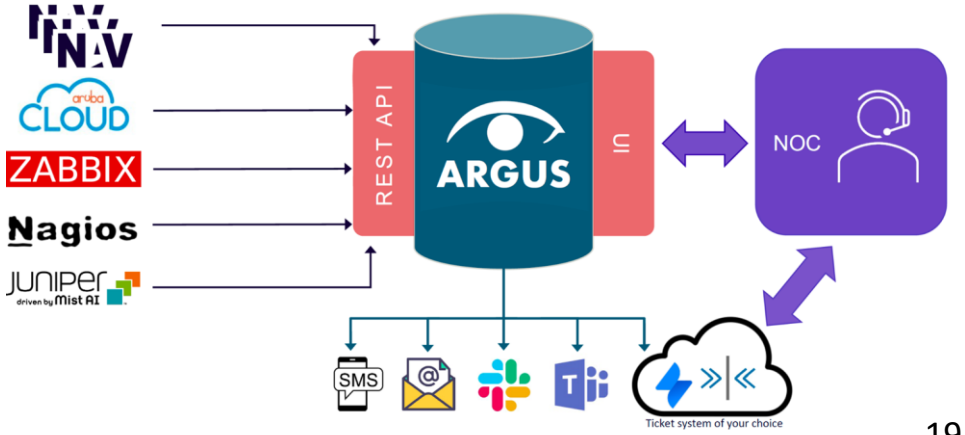
ARGUS

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



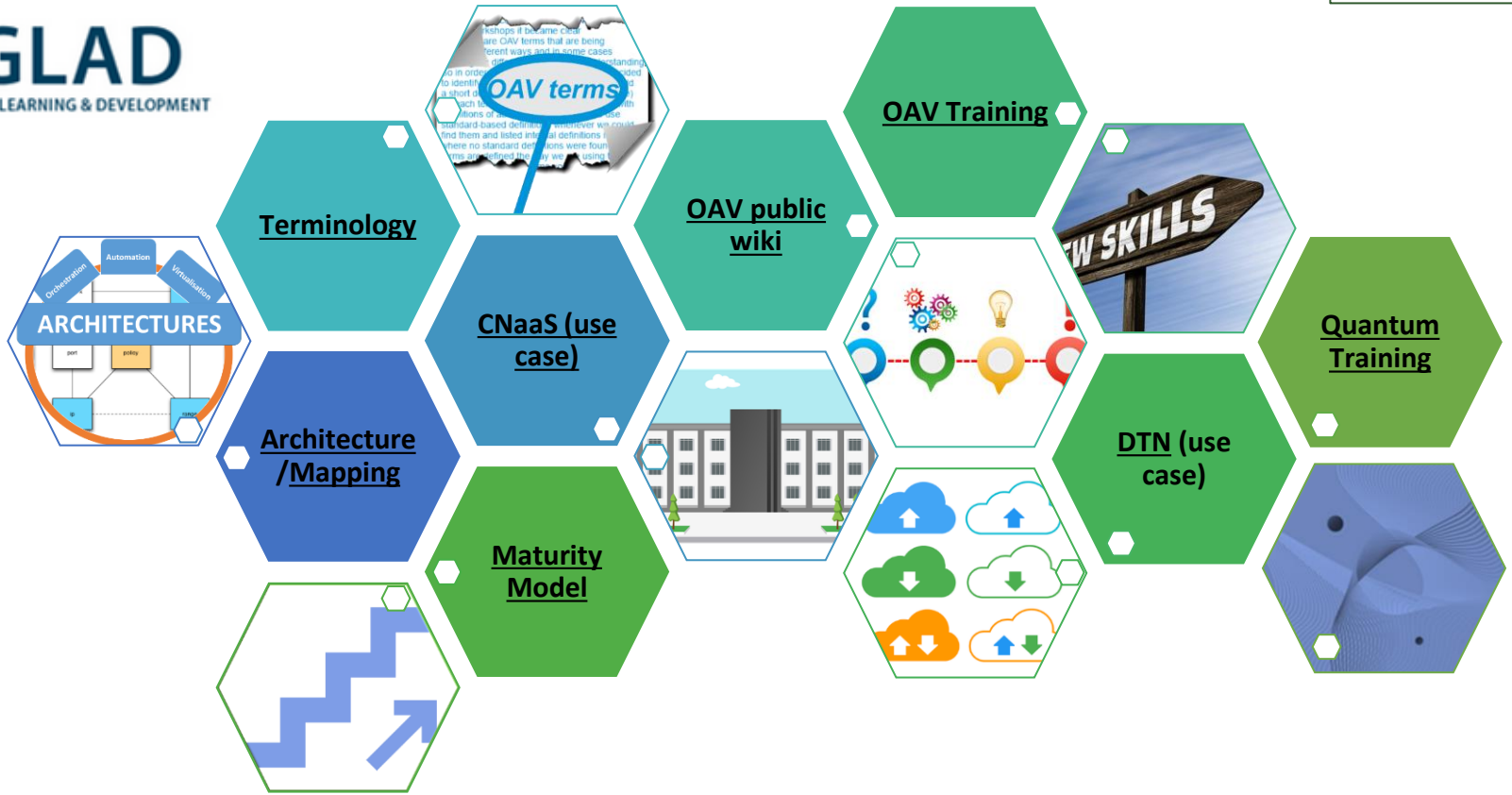


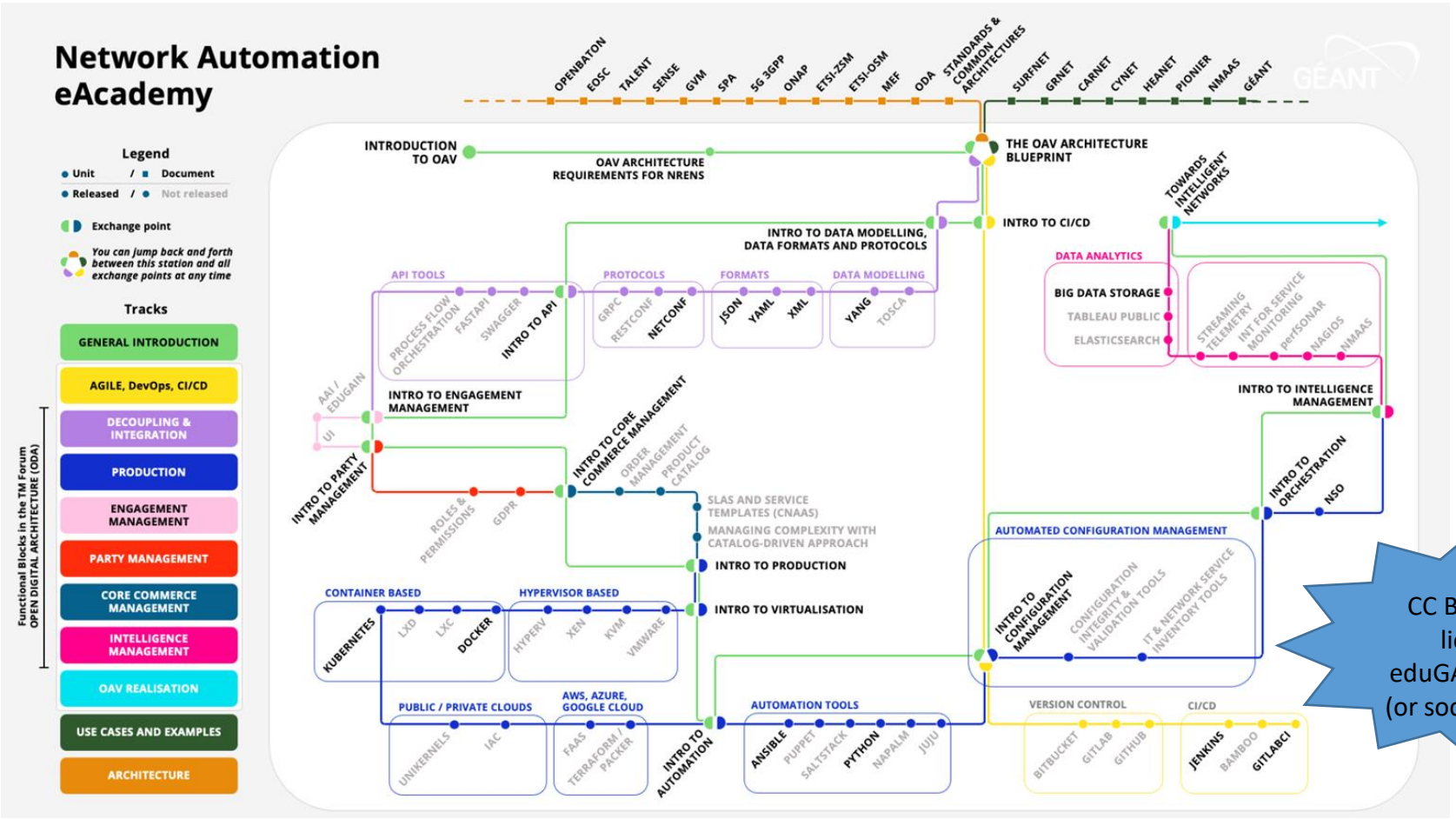
Network eAcademy

Network eAcademy

Powered by:

GLAD
GÉANT LEARNING & DEVELOPMENT





https://wiki.geant.org/display/NETDEV/OAV+Training+Portal

NETDEV Incubator

NETDEV Incubator

A mechanism to include new work during the project

Simple proposal procedure following simple rules

A proposed project MUST be:

- Relevant to the NETDEV project (GN5-1 WP6)
- SMART: *Specific, Measurable, Achievable, Resource- and Time-bound*
- With evident interest for the results from the community

https://wiki.geant.org/display/NETDEV/NETDEV+Incubator

More Information

Future events

- 21 June, Quantum Solutions, online

Contact details

- netdev@lists.geant.org
- https://wiki.geant.org/display/NETDEV/

NMaaS

Argus

TimeMap

WiFiMon

Performance Measurement Platform

perfSONAR

Inventory

Service Provider Architecture

Optical Time and Frequency Networks

RARE

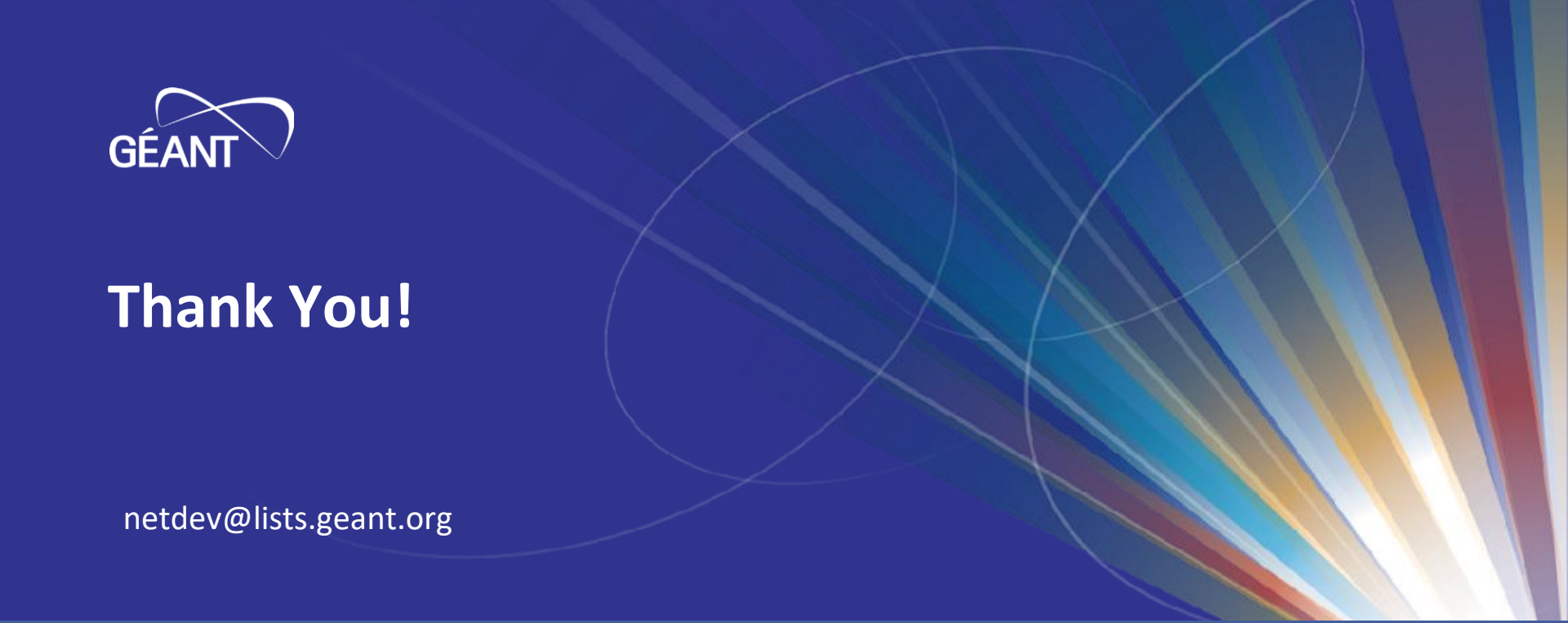
GP4L

Network eAcademy

Quantum Technologies

TechLab

NETDEV Incubator



Thank You!

netdev@lists.geant.org

www.geant.org

Co-funded by
the European Union