More than network, more than data

Designing an ecosystem for federated network services

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Internet2 Community Exchange, Anaheim, CA, USA

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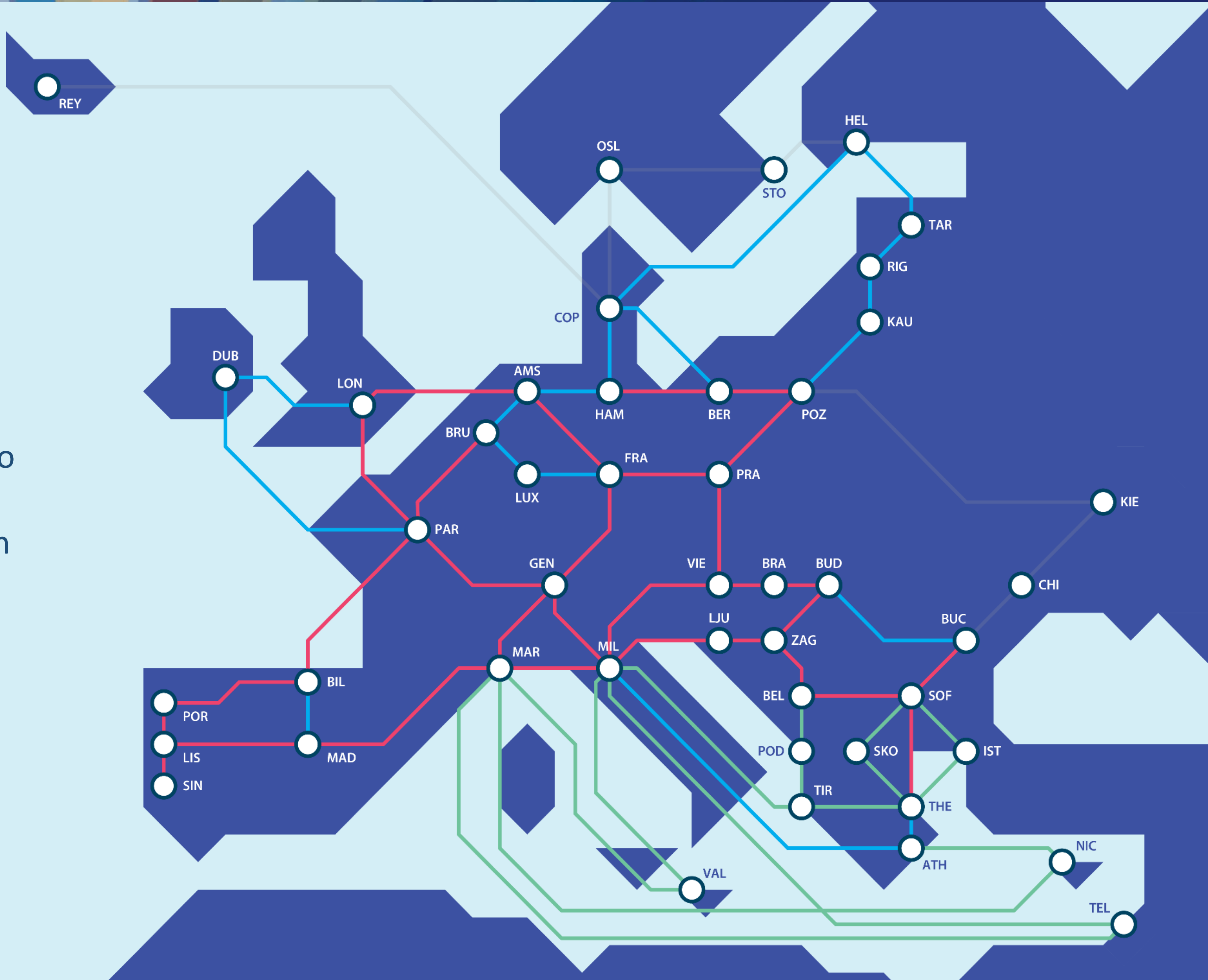
Public (PU)

GN5-2

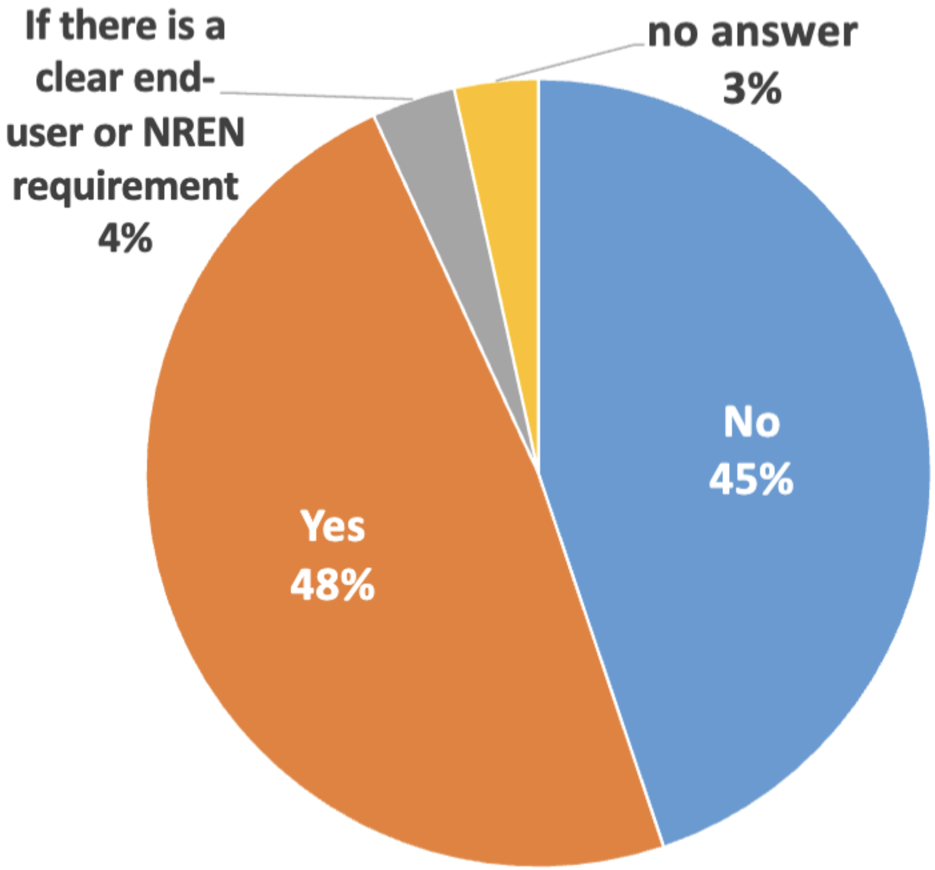
GÉANT Network

The GÉANT network interconnects research, education and innovation communities worldwide, with secure, high-capacity networks.

We design, plan, build and operate the large-scale, high-performance GÉANT network that connects European NRENs to each other and the rest of the world for sharing, accessing and processing the high data volumes generated by research and education communities and for testing innovative technologies and concepts.



Cross-domain Network Orchestration and Automation Collaboration

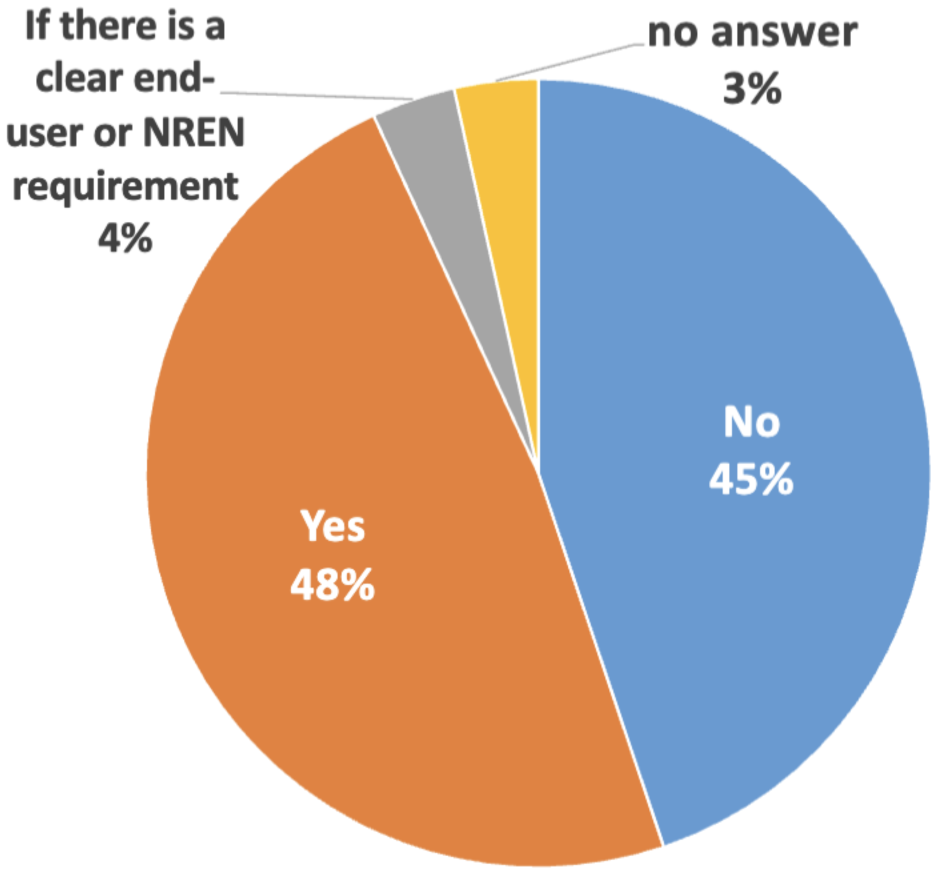


Survey on Orchestration, Automation and Virtualisation in EU NRENs

Low readiness for intra-domain process and service orchestration and automation.

Source: OAV Survey 2019

Cross-domain Network Orchestration and Automation Collaboration



Survey on Orchestration, Automation and Virtualisation in EU NRENs

Low readiness for intra-domain process and service orchestration and automation.

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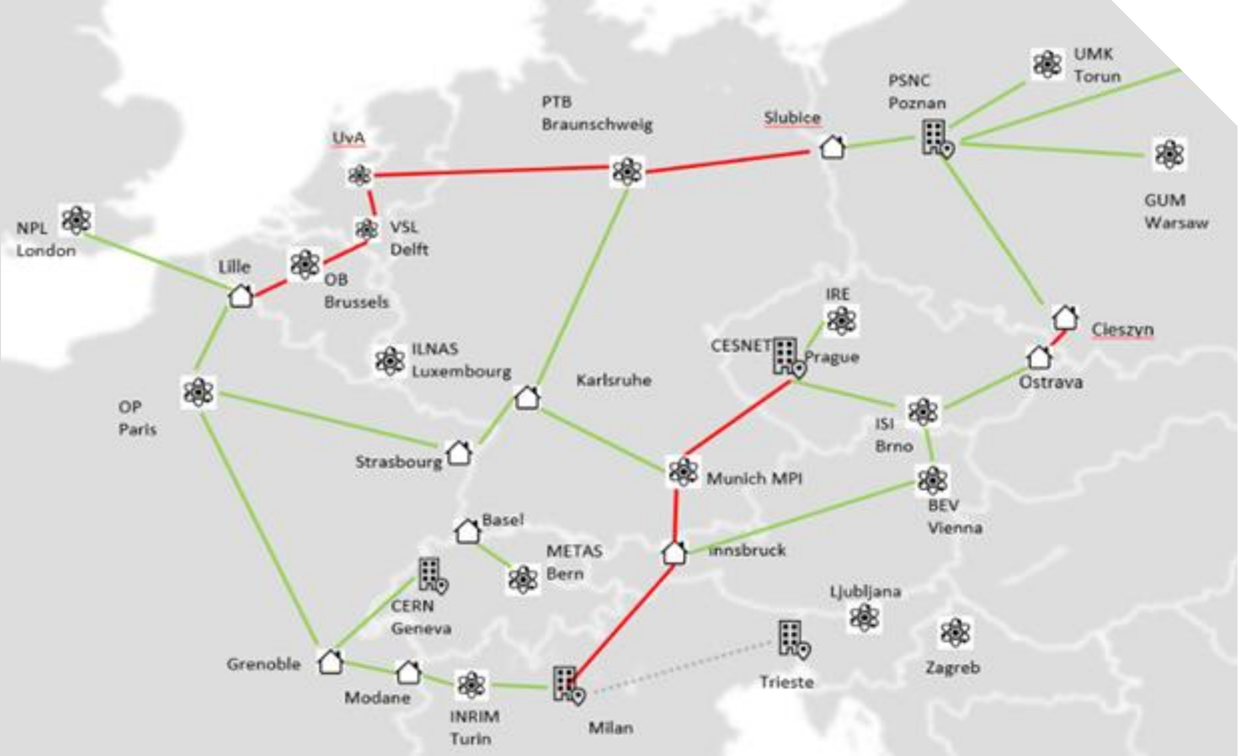
What has changed since then?

Several projects that rely on cross-domain multi-domain collaboration

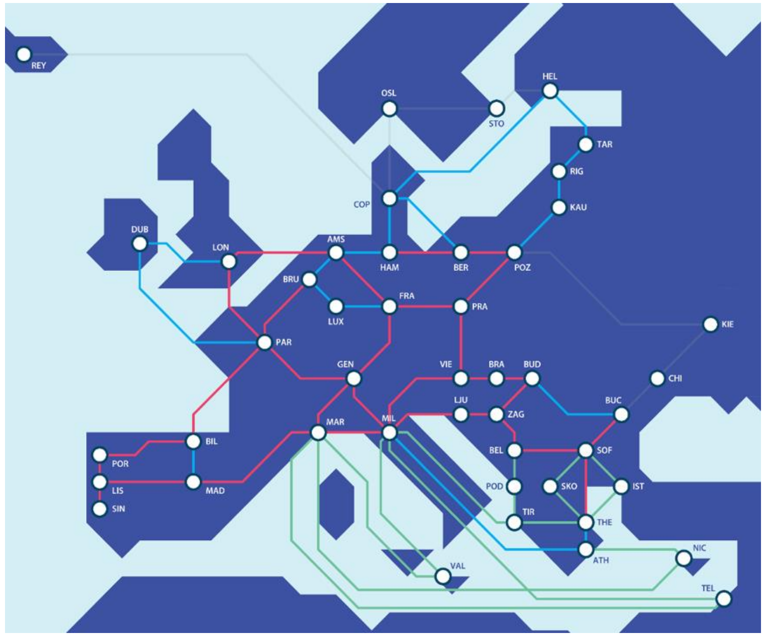
Core Time and Frequency Network (C-TFN)

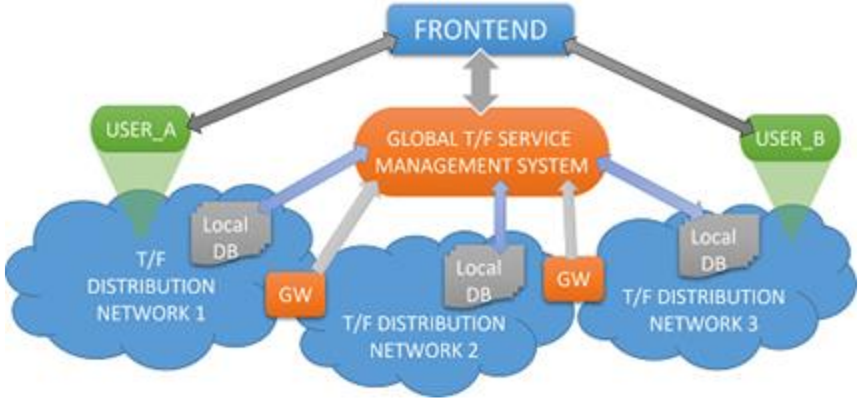
- Parallel to the existing IP/MPLS network
- Distribution and comparison of Time and Frequency Signals
- Distributed, inter-dependant TF sources

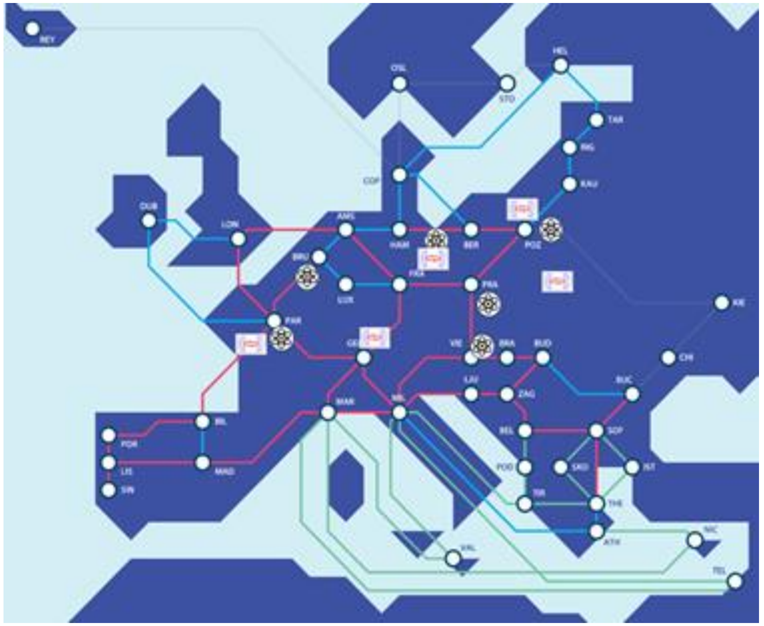


The first established link Sept 2024 between Poznan, Poland – Braunschweig, Germany

C-TFN Monitoring and Management







Monitoring relies on sharing cross-domain TF and IP parameters:

Link state, delay, jitter / amplifiers / RLS state / comparators / flywheel performance

End-to-end view relies on multi-domain data

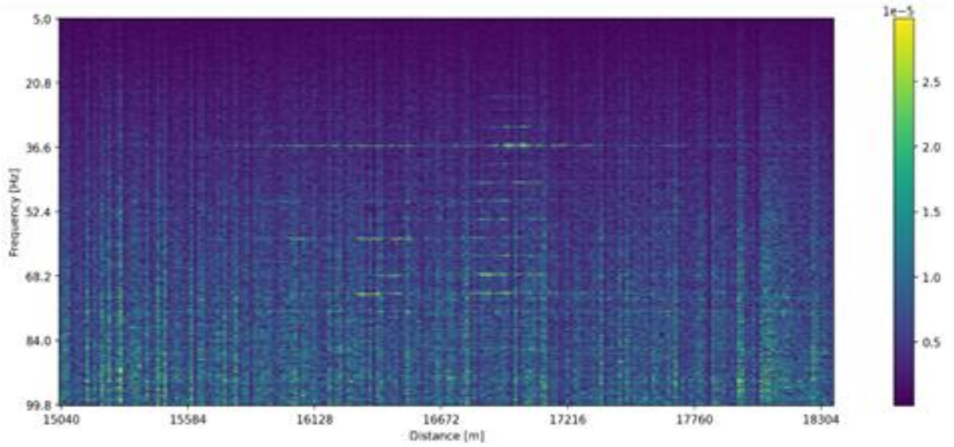
Fibre Sensing

Advancing NREN Network Operations with Fibre Sensing Technologies

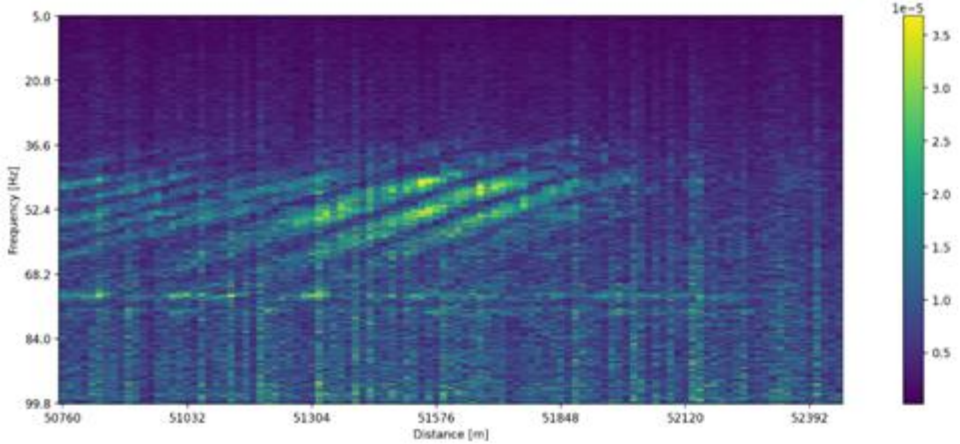
Using **DAS** (Distributed Acoustic Sensing), **SOP** (State of Polarization)and other technologies on existing fiber infrastructure for

- Network monitoring and management
- Data harvesting for R&E usage

Use cases: Security & operations, Civil protection, Scientific Research



ships



whales

Pictures: Fibre Sensing infoshare Dec 2024

Fibre Sensing Ecosystem

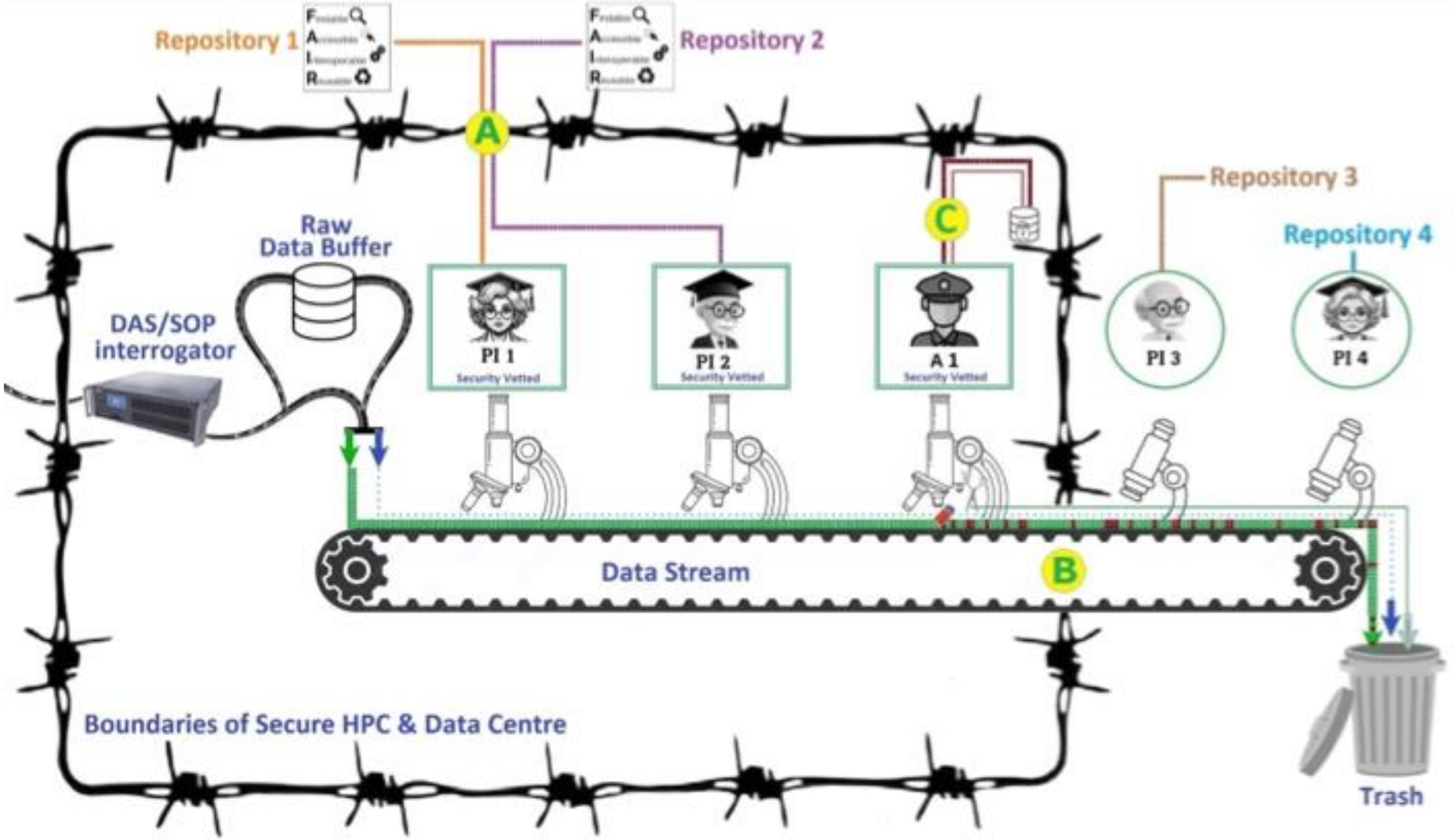
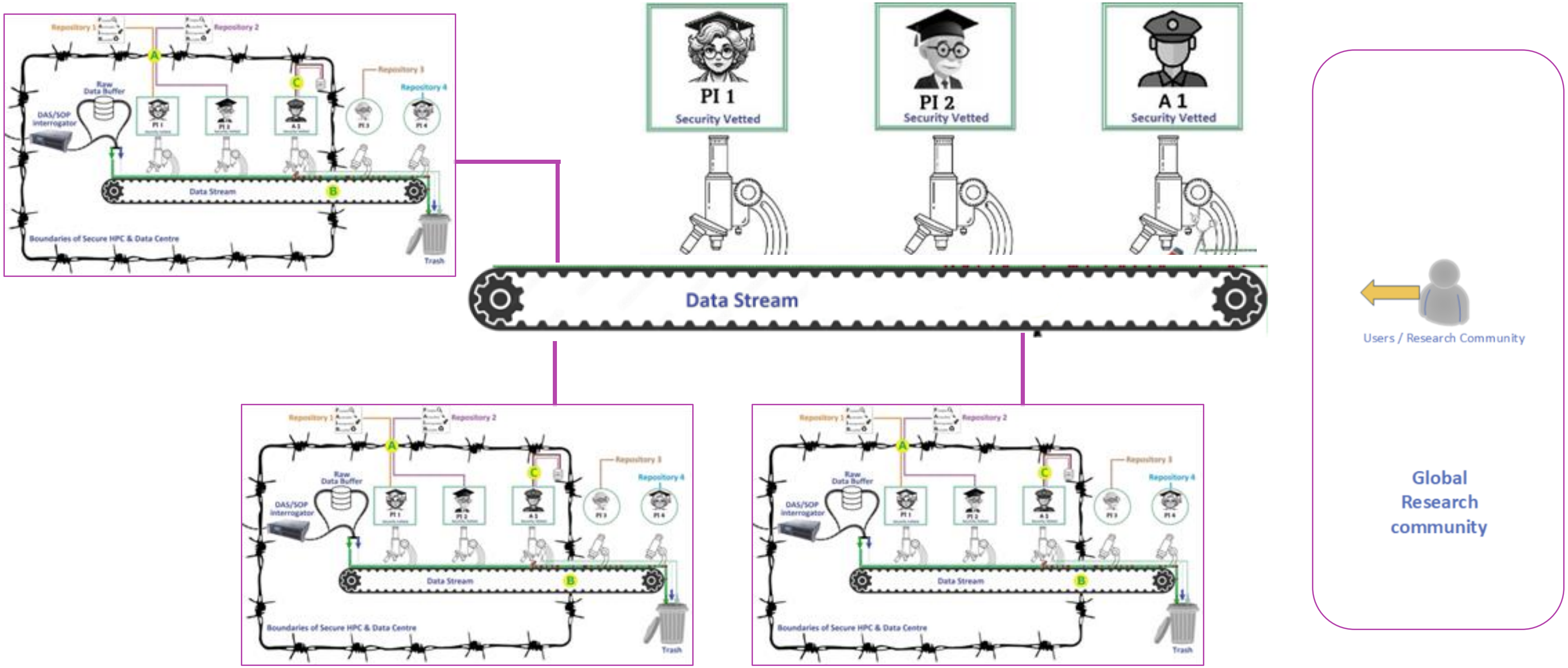
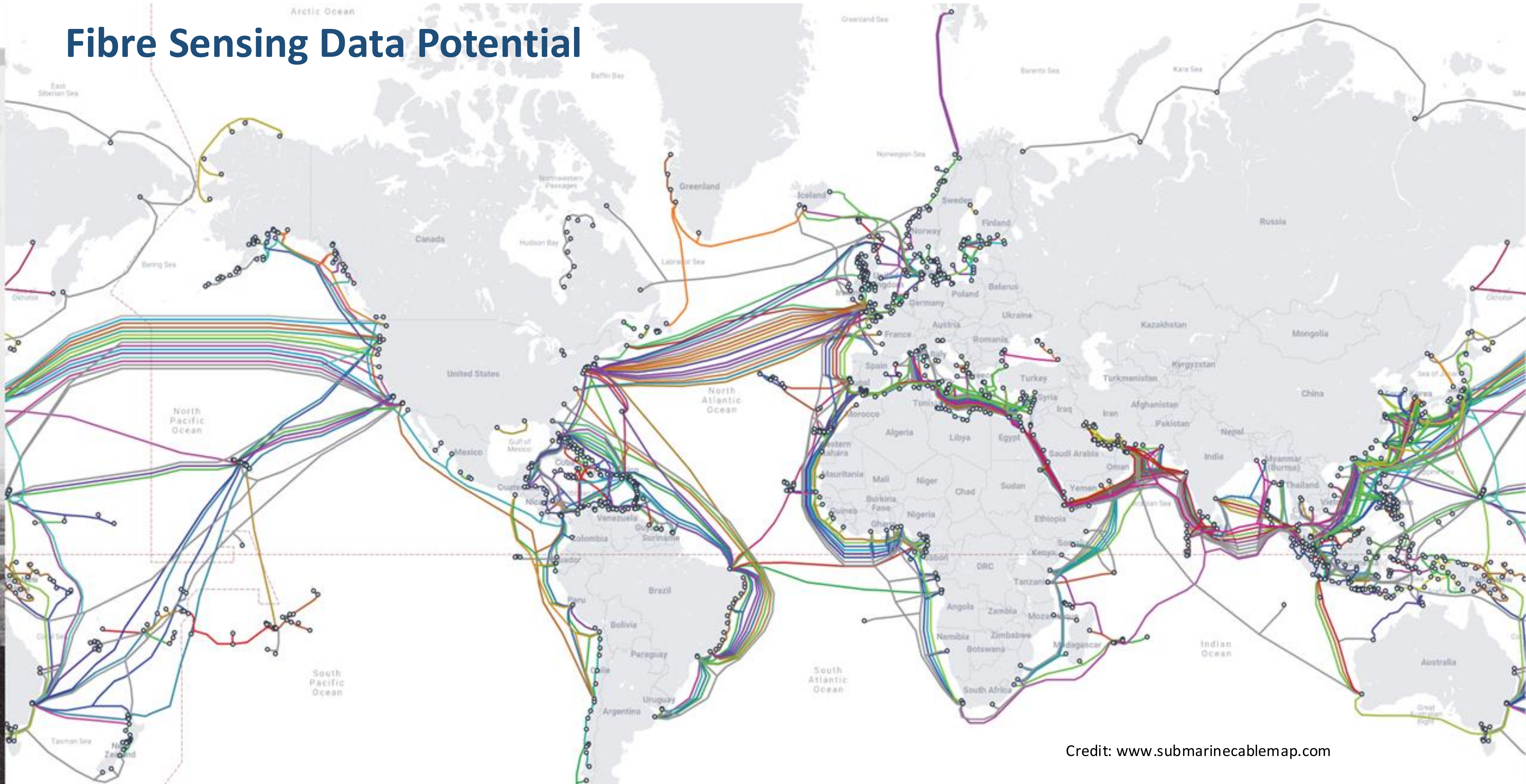


Image source: R. / H. Mihai, DeIC

Possible Federated Fibre Sensing Ecosystem



Fibre Sensing Data Potential



Credit: www.submarinecablemap.com

European Quantum Communication Infrastructure (EuroQCI)

DECLARATION ON A
QUANTUM COMMUNICATION INFRASTRUCTURE
FOR THE EU

All 27 EU Member States

have signed a declaration agreeing to **work together** to explore how to **build a quantum communication infrastructure** (QCI) across Europe, boosting European capabilities in **quantum technologies, cybersecurity and industrial competitiveness.**

Credit: https://irelandqci.ie/euroqci-overview/

Technical and Operational Considerations for Cross-Border QC Interconnection

More than 10 NRENs in National EuroQCI

Similar objectives, limitations, considerations on Infrastructures, Services, User groups (non) R&E/government/commercial…

Architectural considerations:

- Classical and Quantum Networks Coexistence and their interconnectivity
- Interoperability of different quantum solutions and vendors

Operations:

- Roles and responsibilities: NRENs, GÉANT, non-R&E organisations
- Multi-domain, cross-border monitoring

A service in scope: Dedicated Key Management System (KMS) to exchange keys between different National QCIs

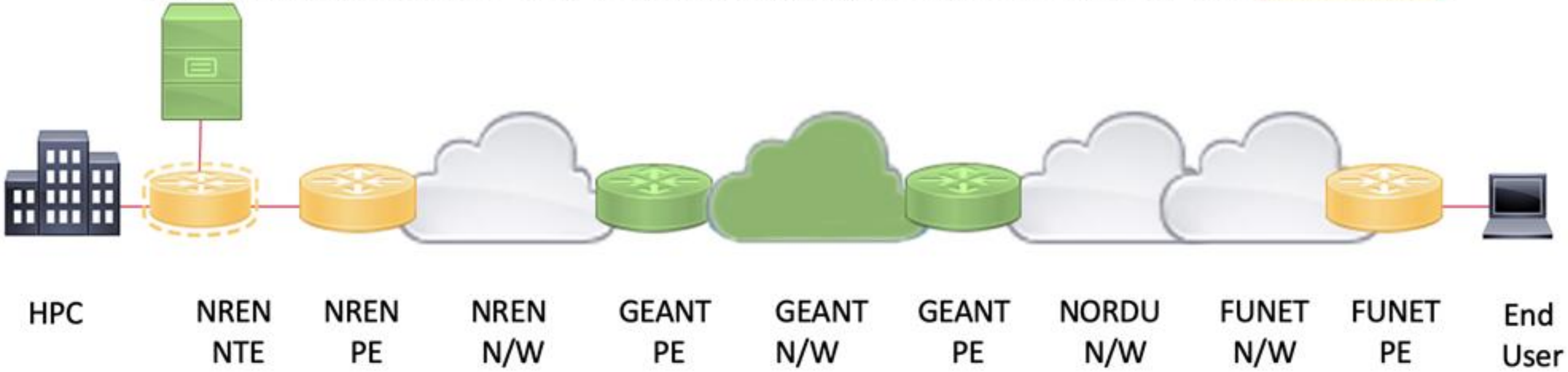
Credit: https://irelandqci.ie/euroqci-overview/

Interconnecting European HPC centres

EuroHPC Operations, Administration, and Management - Considerations

Scenario 3

GÉANT have access to GÉANT equipment as well as some access to NREN NTE (SNMP) and some access to NREN PE (SNMP, RO CLI / looking glass) and also have a server on-site (PerfSONAR)



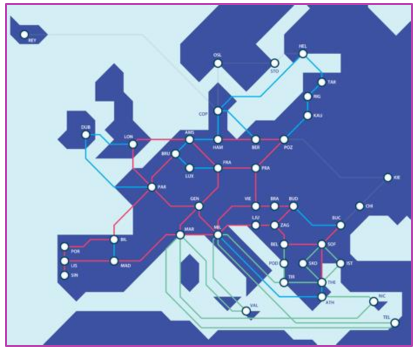
Pros: One party able to troubleshoot layer3 issues through the entire route
Single ticket for single issue
Global visibility of SLA metrics
Global visibility of traffic stats

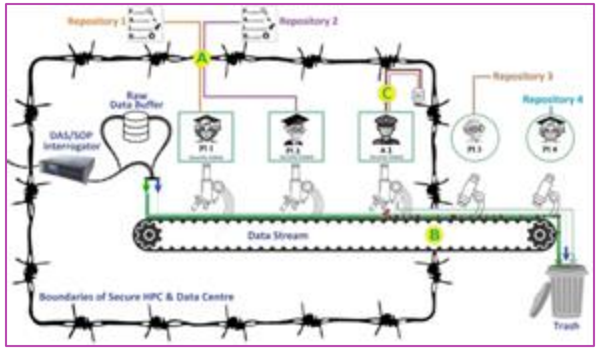
Cons: Autonomy / political issues?

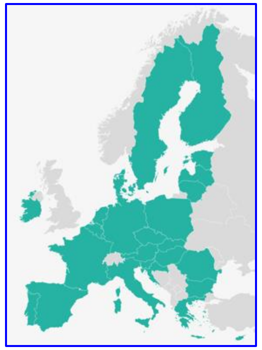
Slide Source: K. Slater, GÉANT, EuroHPC, 33rd STF - Berlin, Nov 2024

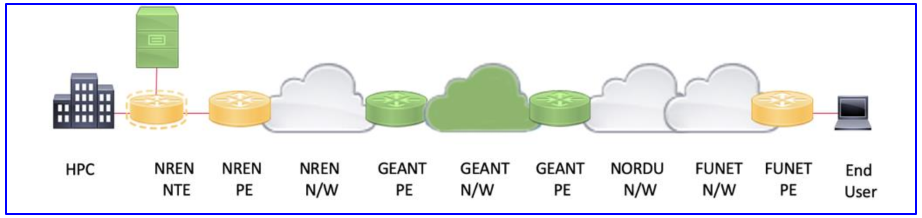
What We Need

Strong, fast and powerful infrastructure





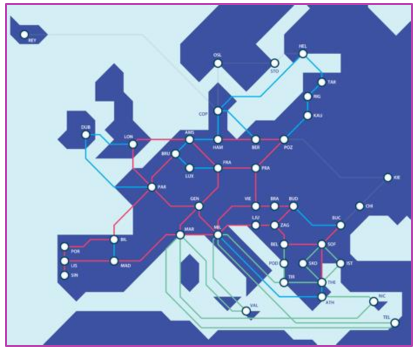


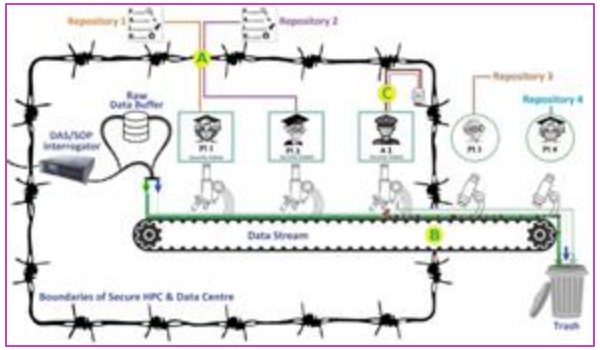
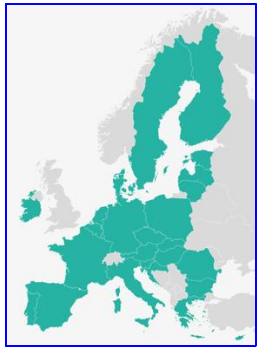
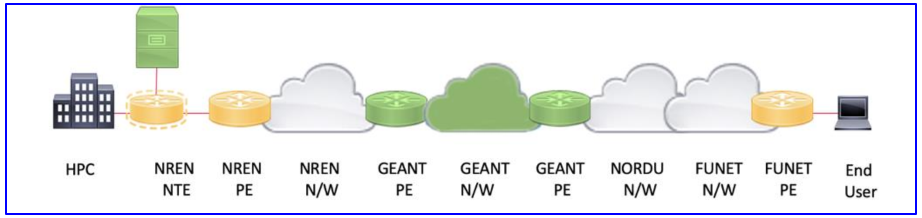


What We Need

What We Have

Strong, fast and powerful infrastructure



Knowledge, Tools, Services, Models, Collaboration…

perf2ONAR years

MetrANOVA

ARGUS

nmaas

Maat

TimeMap

Workflow Orchestrator Programme

RARE

GP4L

Network eAcademy

eduGAIN

eduTEAMS

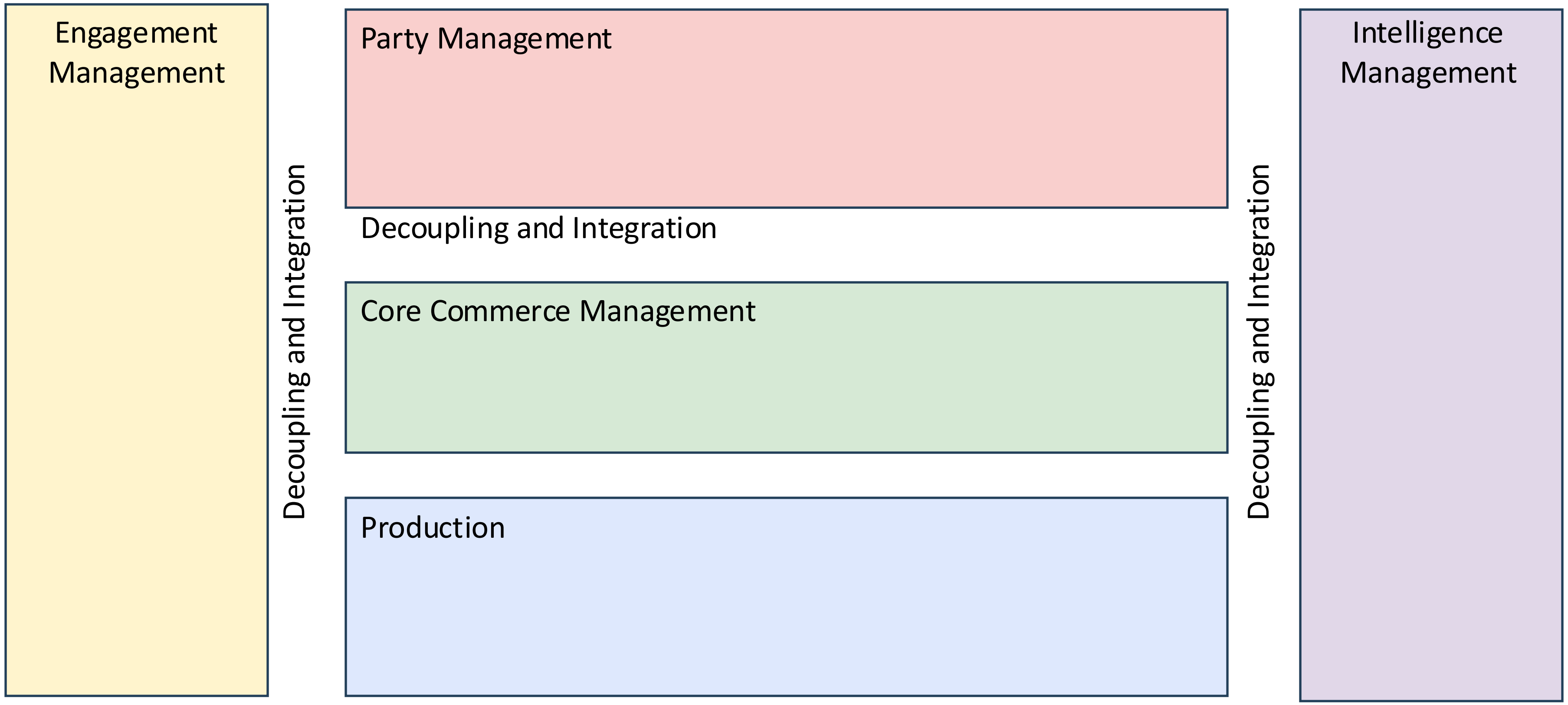
Community Programme

GNA-G
Global Network Advancement Group

THE GLOBAL RESEARCH PLATFORM
GRP

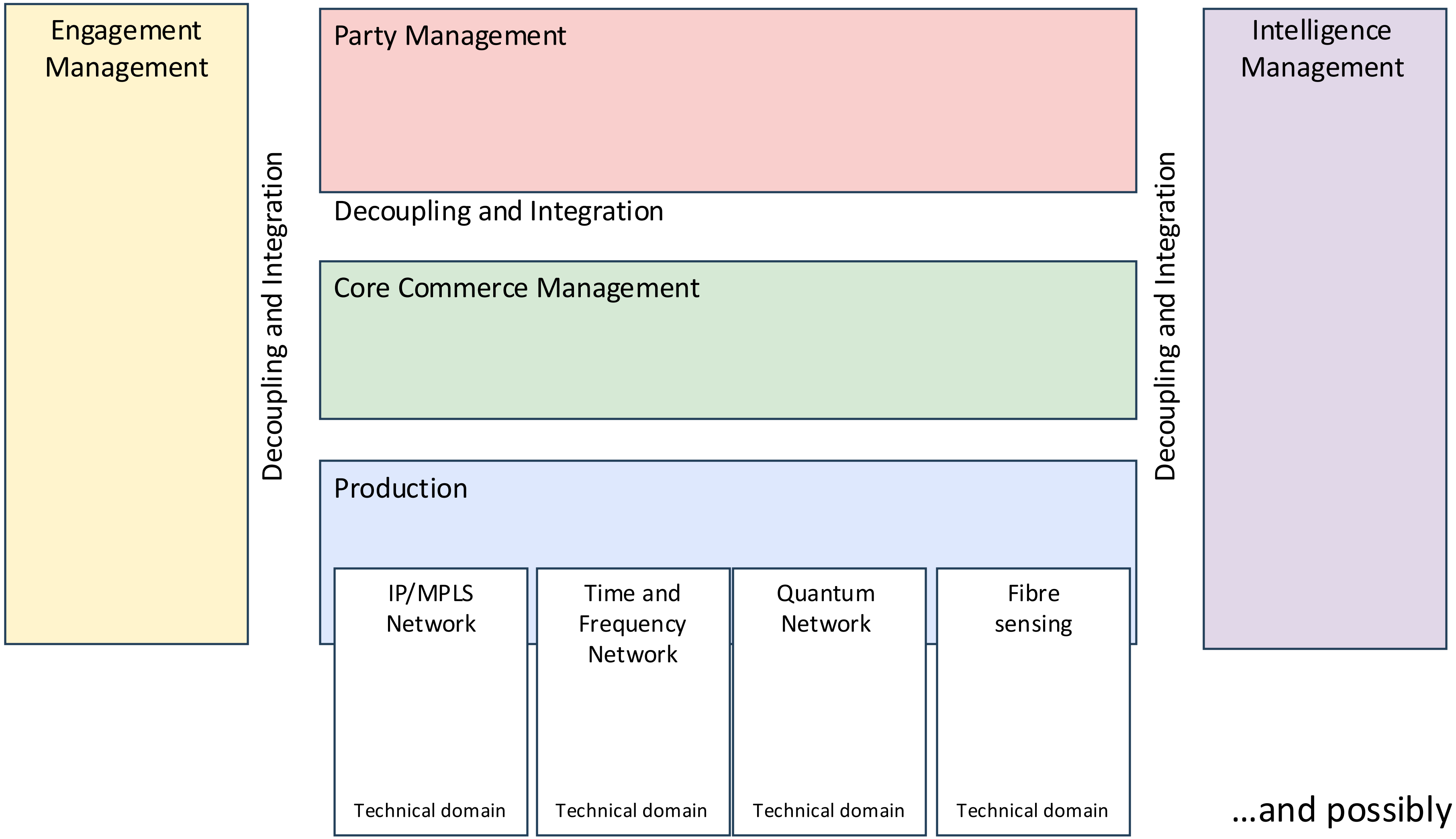
…and more…

TMForum Open Digital Architecture Blueprint



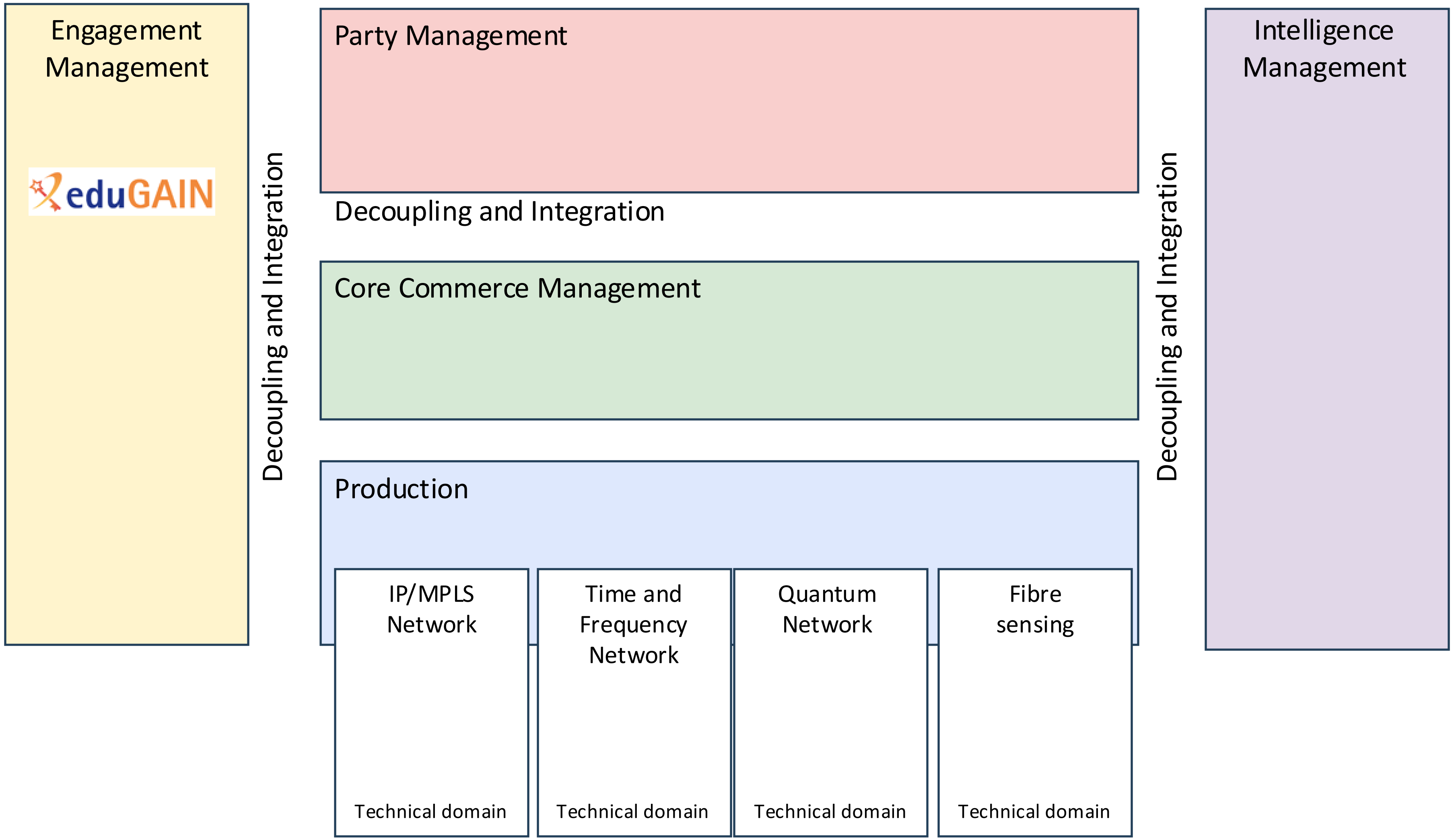
https://www.tmforum.org/oda/

GREN Technical Domains

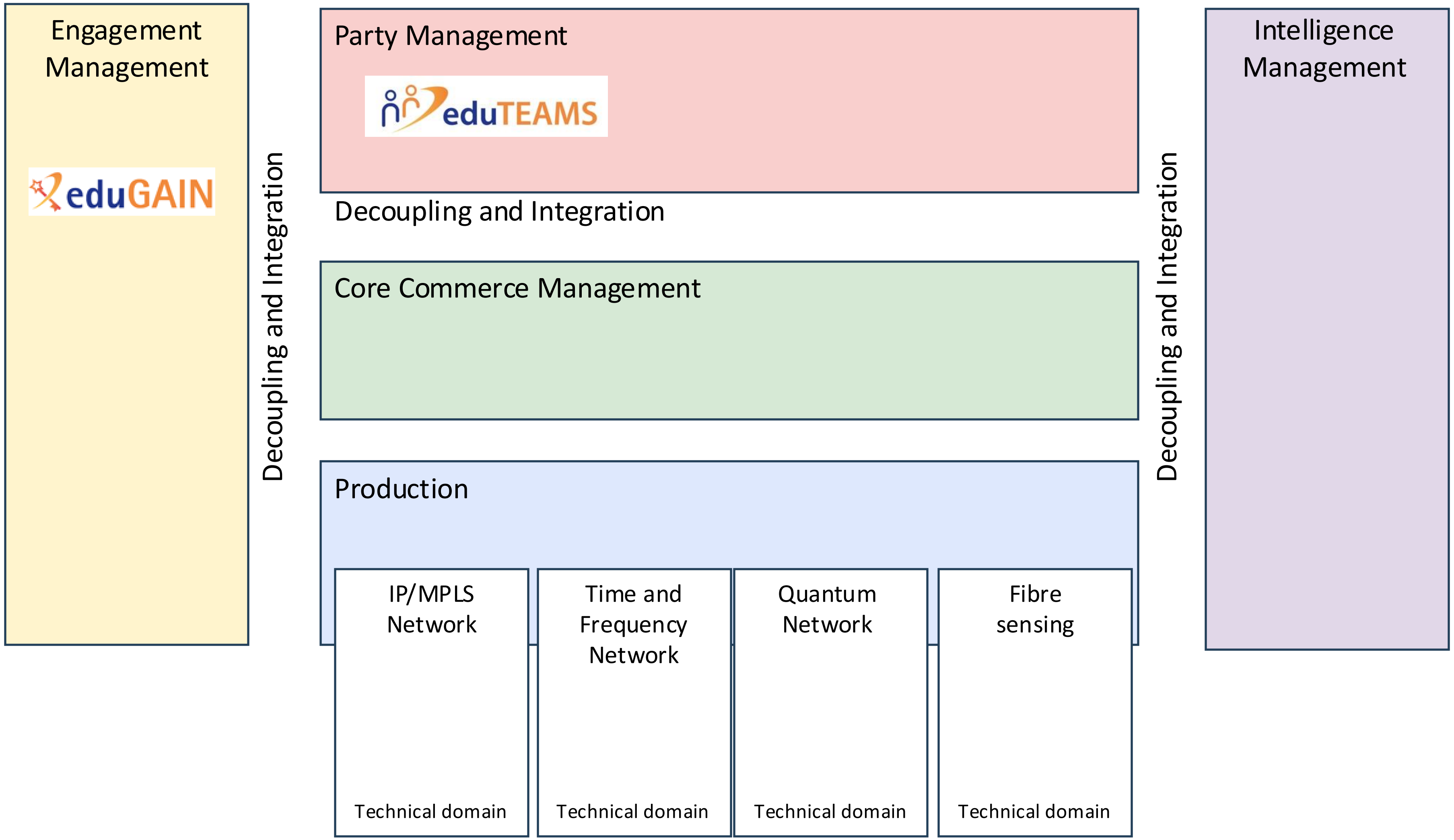


…and possibly more…

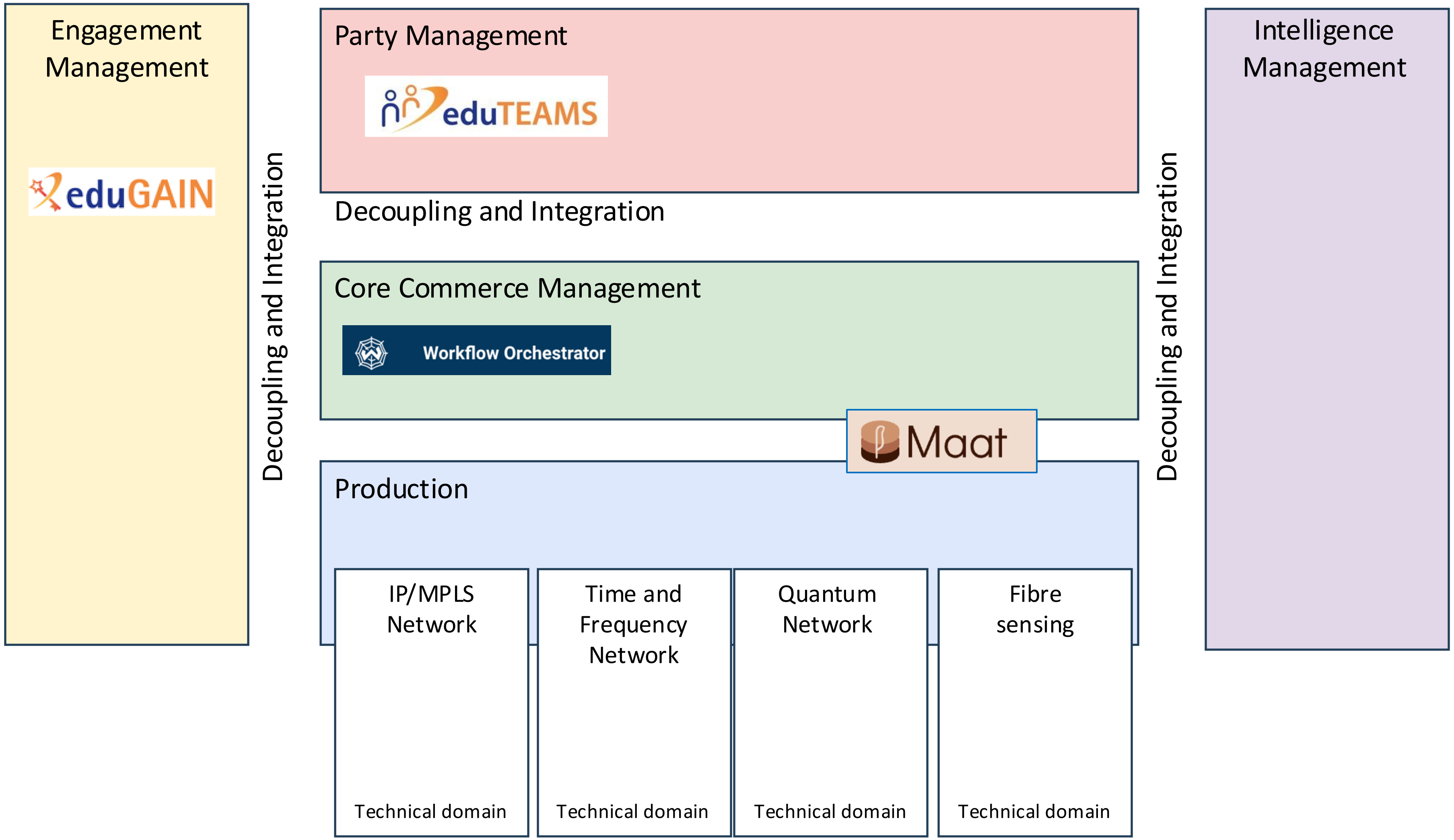
Engaging with Users and Stakeholders



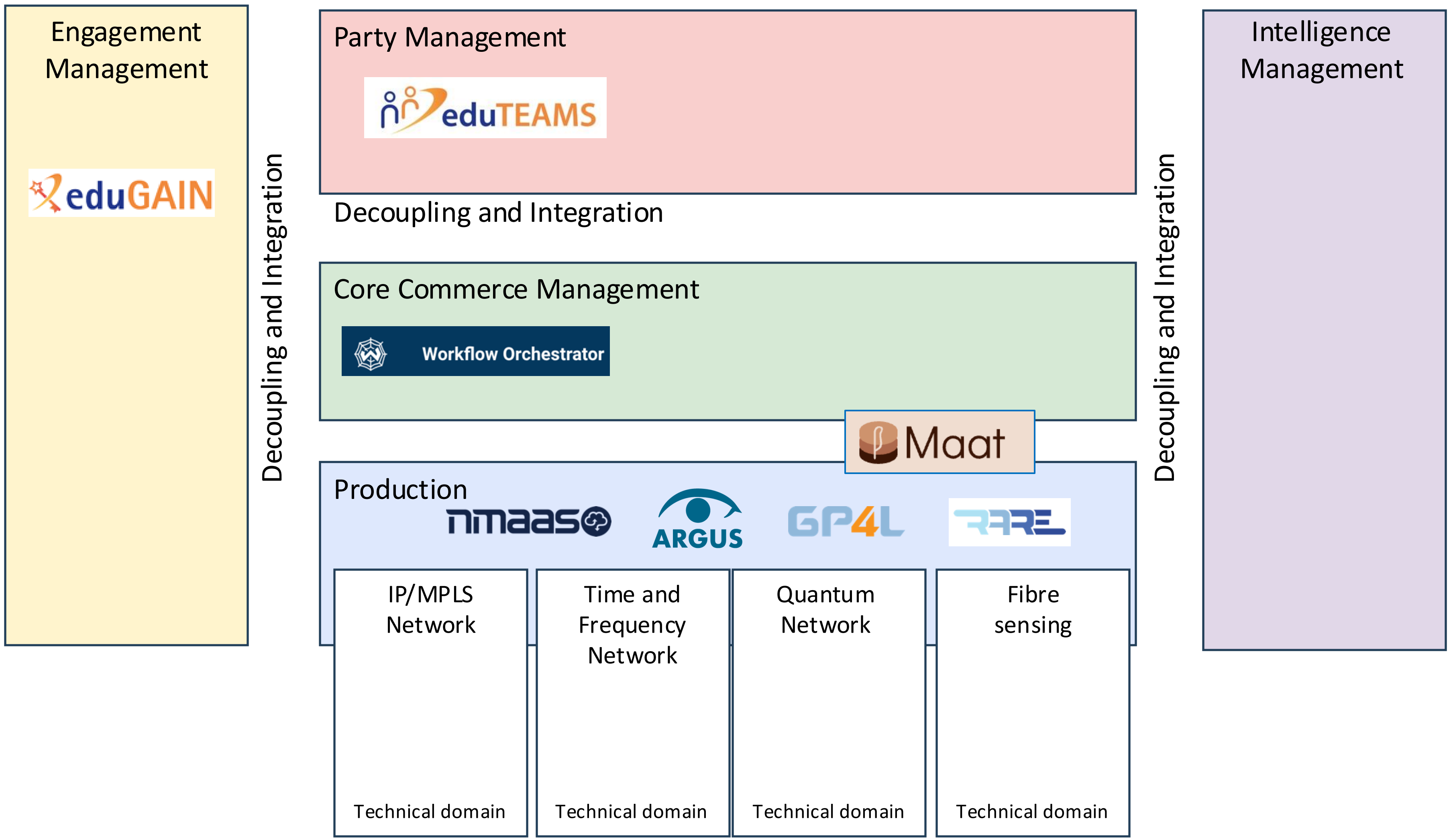
Managing Persons and Organisations, Access and Rights



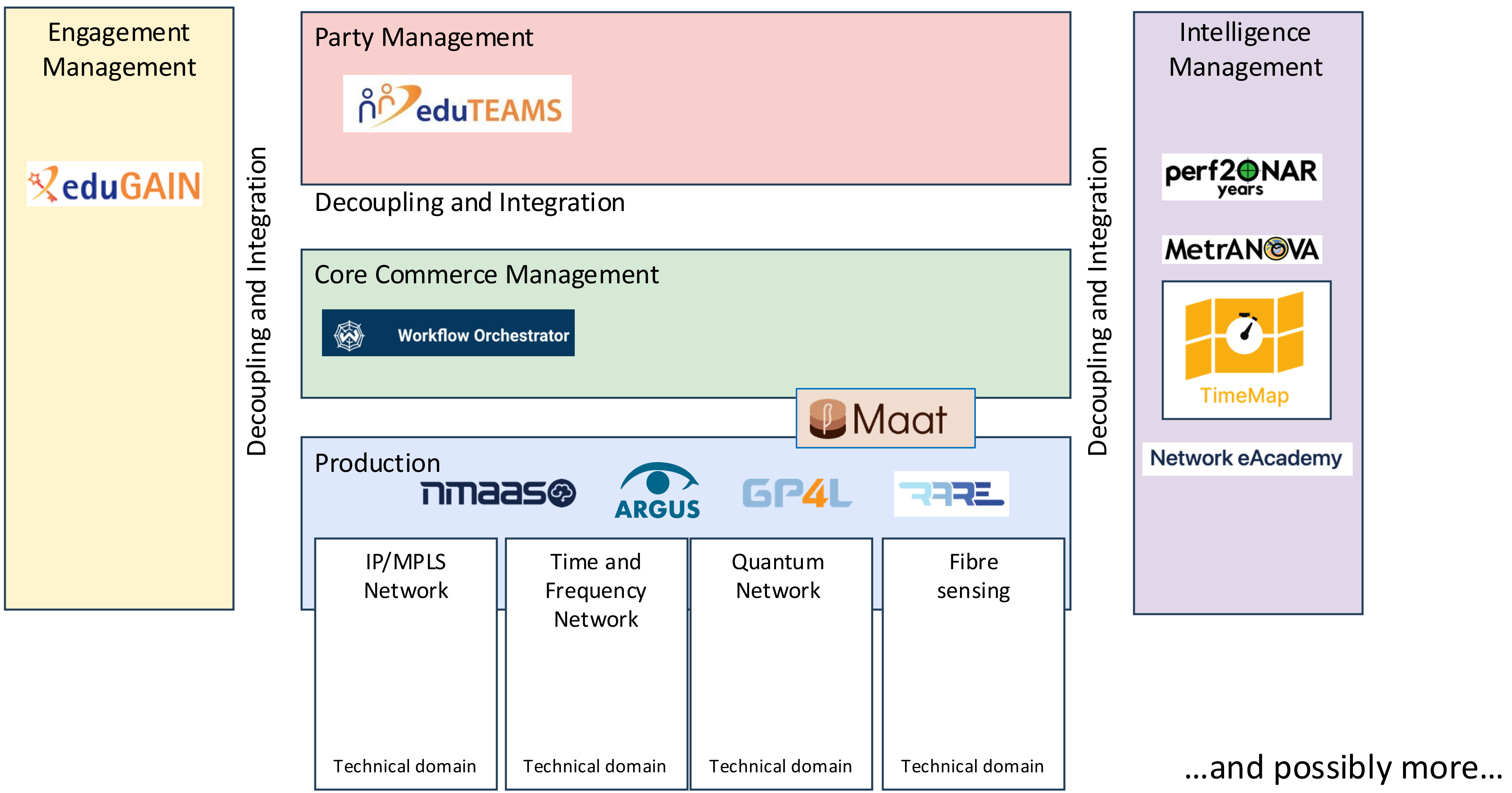
Provisioning, Orchestration, Product Offers



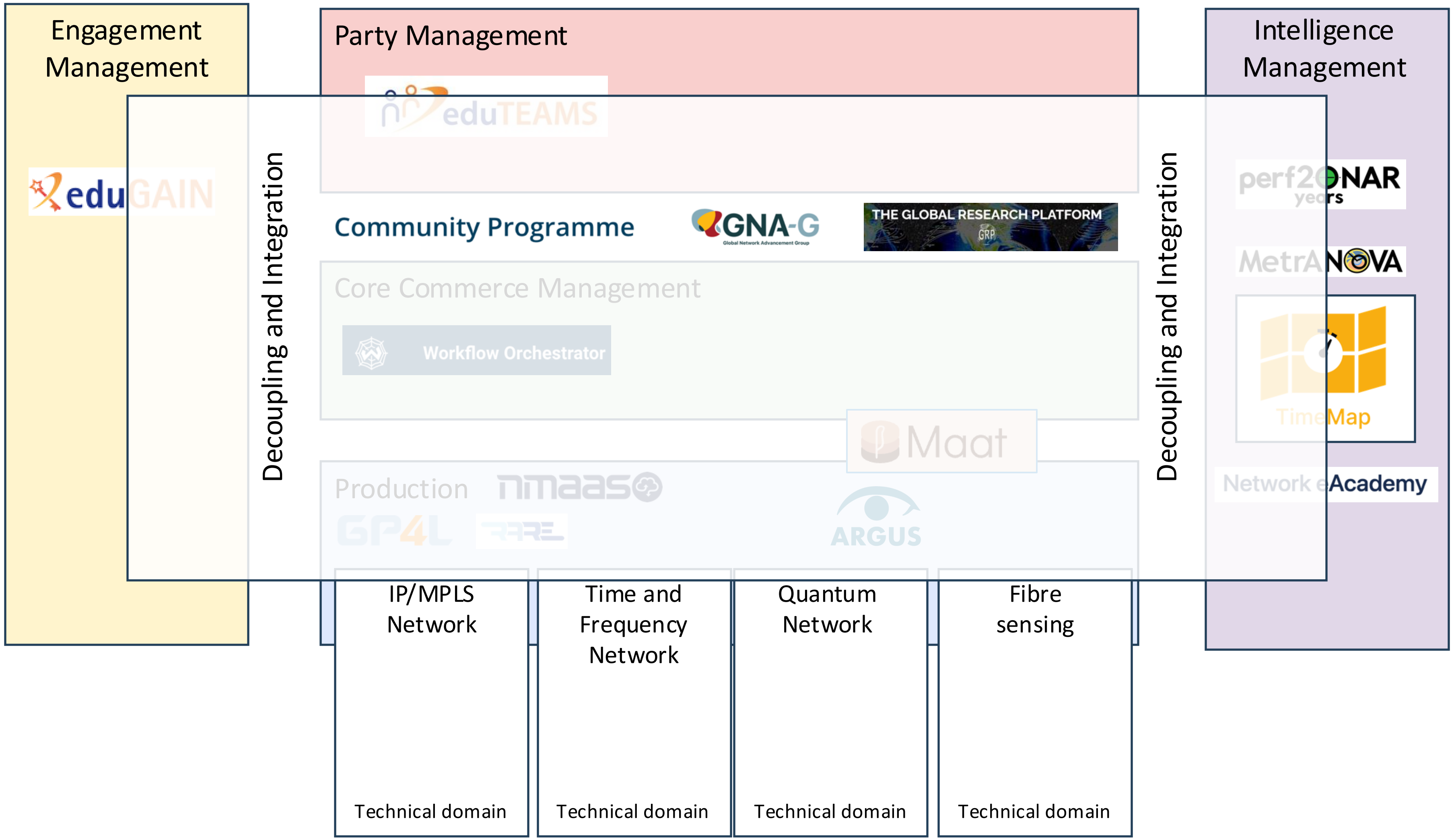
Service and Resource Management



Monitoring, Data Analytics, Knowledge Management



Flexible Integration



Advancing our Networks Together

Engagement Management

eduGAIN

Decoupling and Integration

Party Management

eduTEAMS

Community Programme

GNA-G

THE GLOBAL RESEARCH PLATFORM

Core Commerce Management

Workflow Orchestrator

Maat

Production

nmaas

ARGUS

GP4L

RARE

IP/MPLS Network	Time and Frequency Network	Quantum Network	Fibre sensing
Technical domain	Technical domain	Technical domain	Technical domain

Decoupling and Integration

Intelligence Management

perfSONAR 20 years

MetrANOVA

TimeMap

Network eAcademy

Thank You

www.geant.org

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