Network eAcademy

Maria Isabel Gandia Carriedo, CSUC/RedIRIS

INEX Member Meeting
7th September 2023, Dublin, Ireland

Maria Isabel in a Nutshell

CATNIX

Catalonia Neutral
Internet Exchange

Maria Isabel in ~~a~~ *three* Nutshell*s*

CATNIX
Catalonia Neutral Internet Exchange

ANELLA CIENTÍFICA

Maria Isabel in ~~a~~ three Nutshells

CATNIX
Catalonia Neutral Internet Exchange

ANELLA CIENTÍFICA

GÉANT
Networks • Services • People

The GÉANT Project

GÉANT's vision is to ensure equal network access for all scientists across Europe to the research infrastructures and the e-infrastructure resources

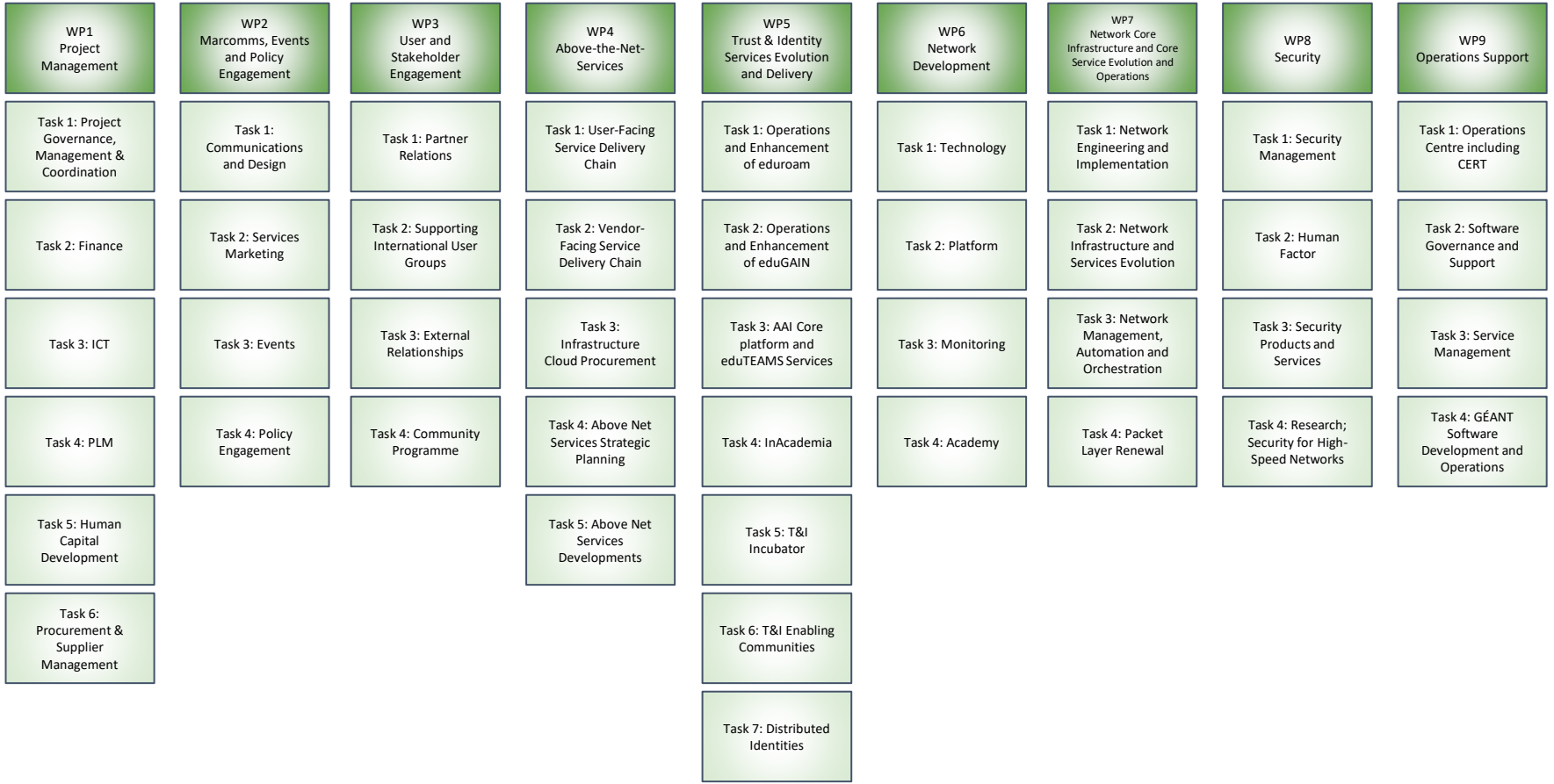
The GÉANT Project is a part of the European Union's Horizon Europe research and innovation programme under the seven-year Framework Partnership Agreement (FPA)

500 contributors from 37 partners - European R&E Institutions

50 M users

GÉANT 5-1 (GN5-1) Project duration: 1 Jan 2023 – 31 December 2024

The GÉANT 5-1 Project Structure



The GÉANT 5-1 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

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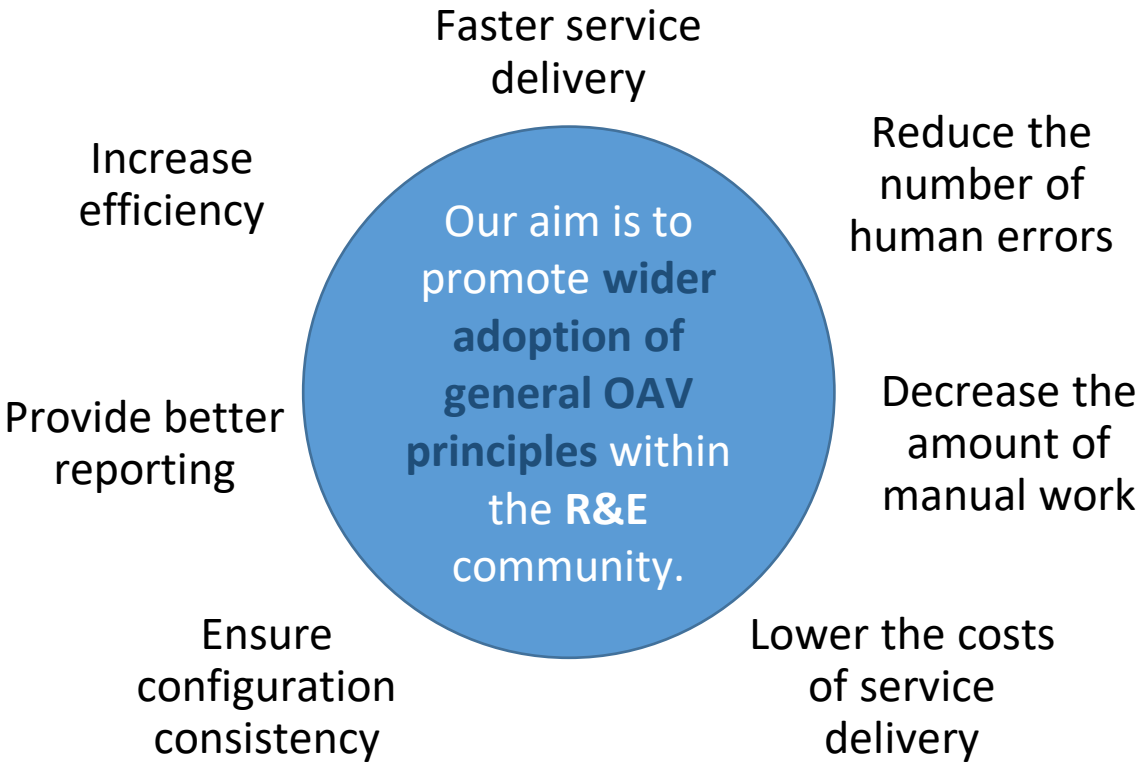
Agenda: Network eAcademy

- Introduction: Orchestration, Automation and Virtualisation
- Architecture/Mapping
- Training
- Terminology
- Maturity Model
- Promoting Orchestration, Automation and Virtualisation

OAV: Orchestration, Automation and Virtualisation



Why Architecture, Training, Terminology, Maturity Model…?

- OAV Survey to the NRENs (published in Sep 19):

  https://www.geant.org/Projects/GEANT_Project_GN4-3/GN43_deliverables/D6-2_Automation-and-Orchestration-of-Services-in-the-GEANT-Community.pdf

- Several discussions and workshops around the topic:
  - GN4-3 Future Service Strategy Workshop, May 19
  - BoF session at TNC, June 19
  - STF17, July 2019
  - Network Management and Monitoring Workshop (NEMMO), Oct 19

Collaborative approach to OAV in the GÉANT Community

Strong need for collaboration and exchange of knowledge and expertise

Knowledge as a gap

We speak different languages

A generally accepted architecture blueprint needed

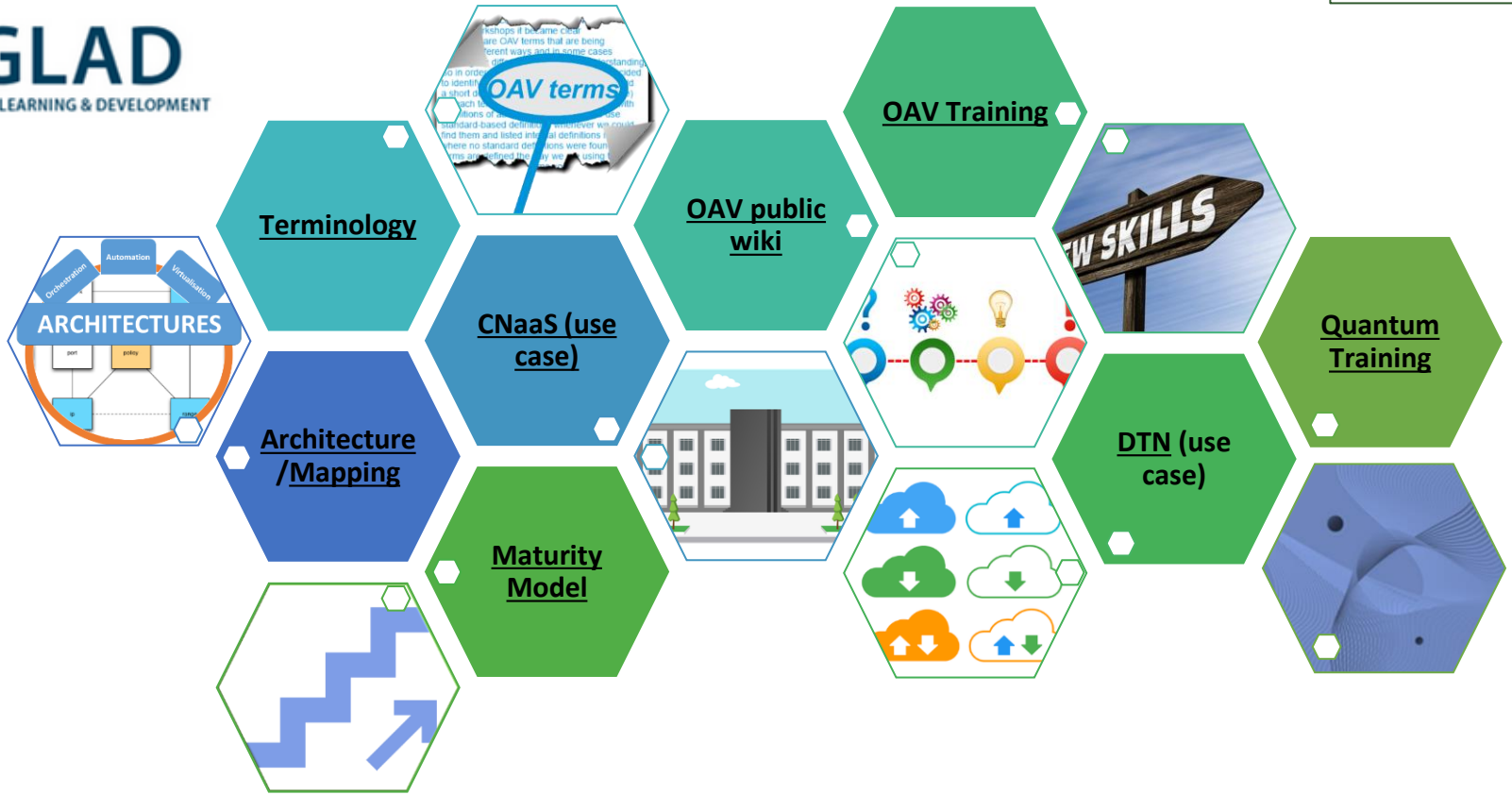
NRENs are willing to share experiences and learn from others

Network eAcademy

Network eAcademy

Powered by:

GLAD
GÉANT LEARNING & DEVELOPMENT

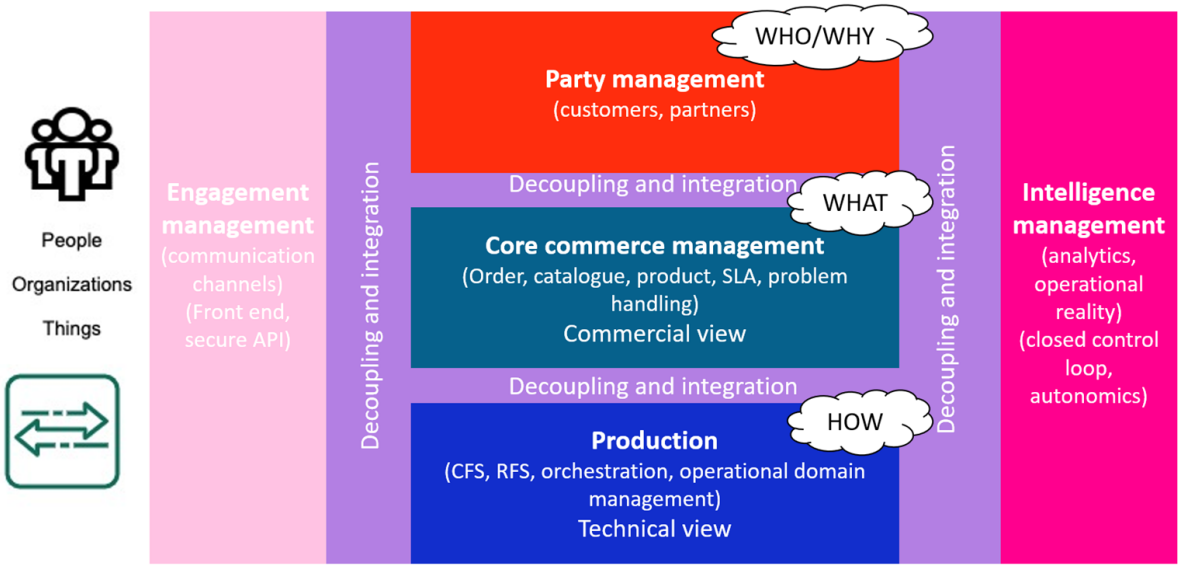


Architecture & Mappings

Architecture

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

Align efforts → **Find similarities** → **Collaboration** → **Interoperability**



NREN mappings to date:

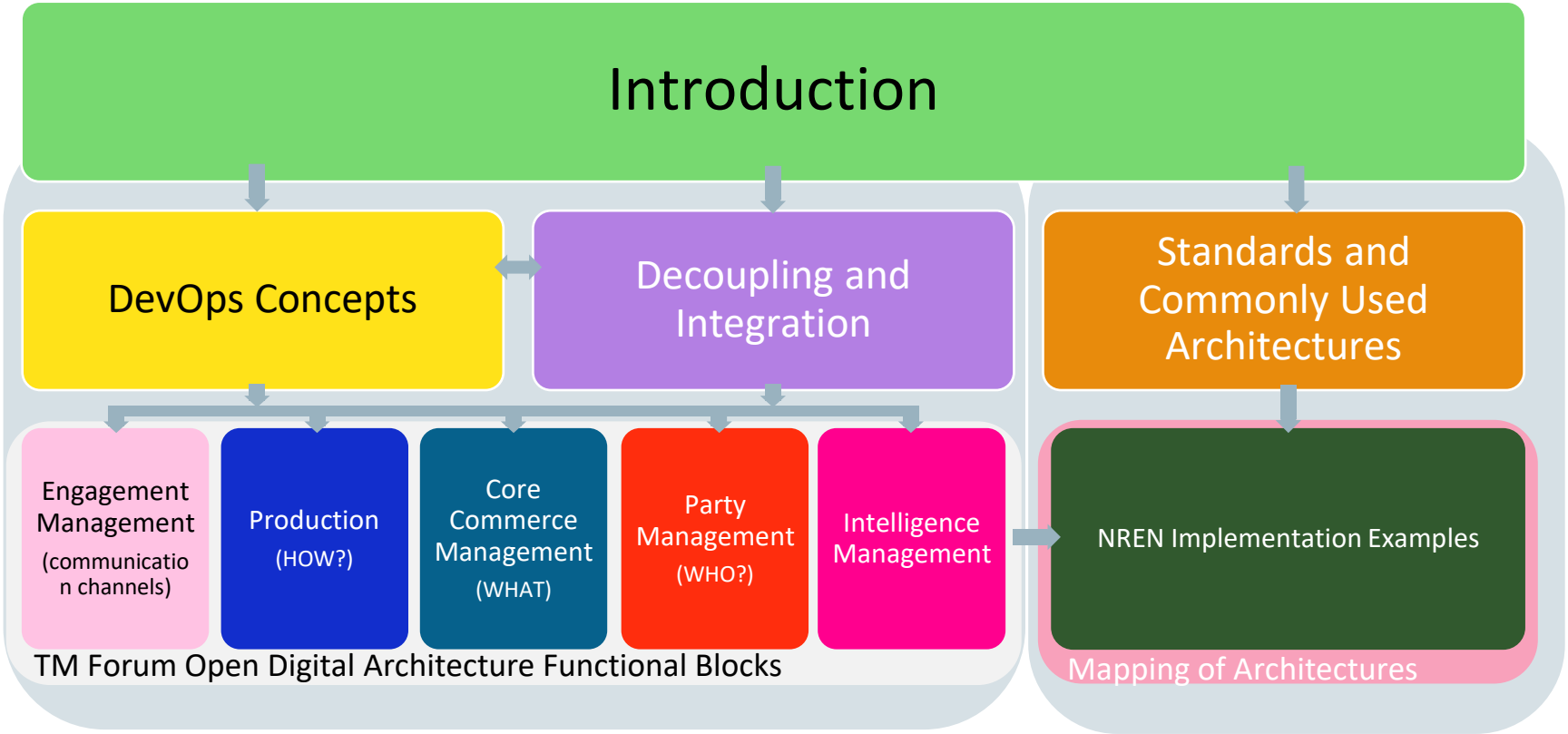
- CARNET
- CYNET
- GÉANT
- GRNET
- HEAnet
- PIONIER
- SURFNET

Platform mappings to date:

- Argus
- NMaaS
- PMP

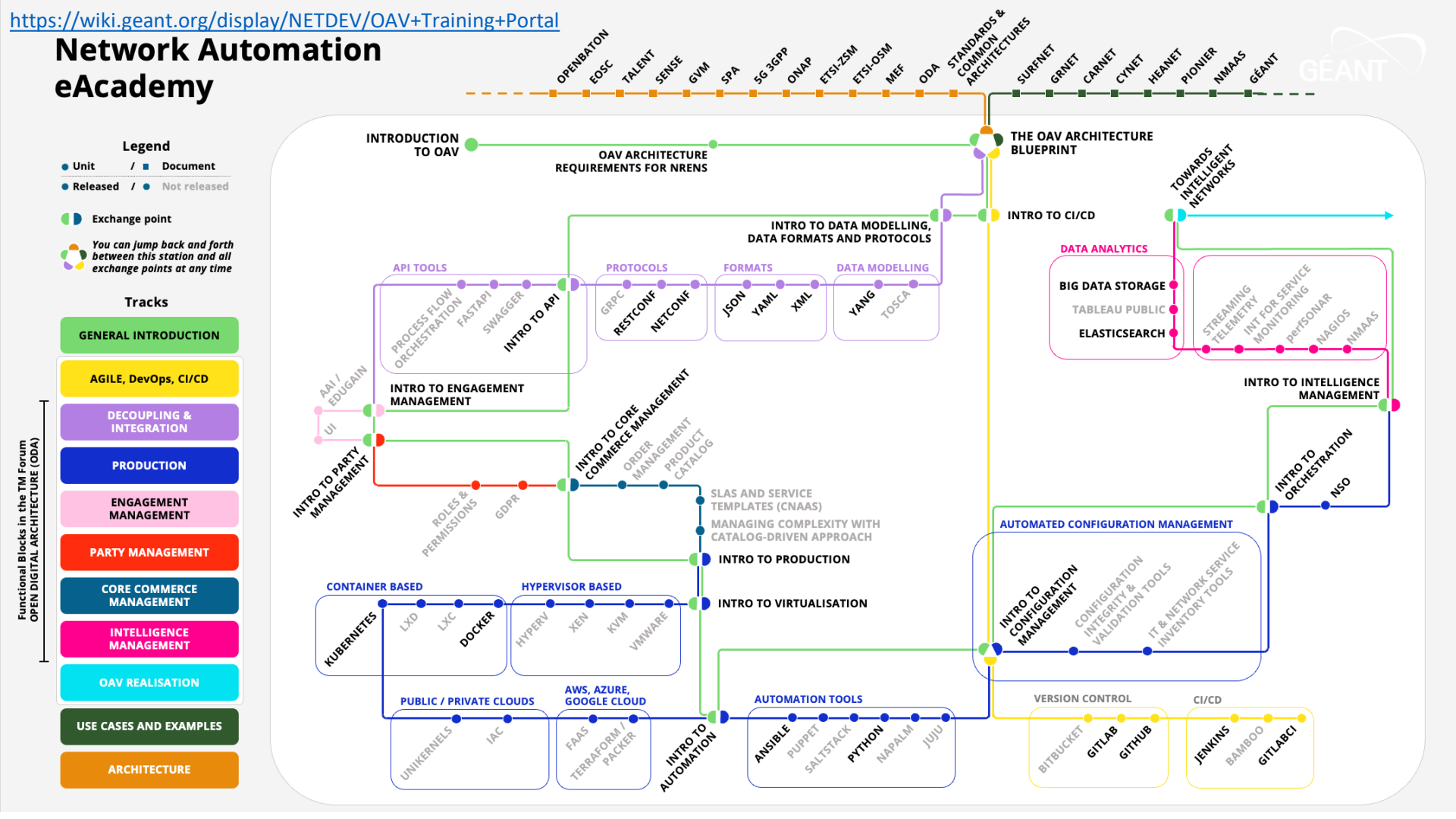
Knowledge Map for the Training

Training



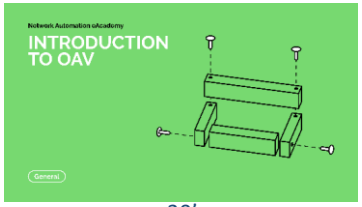
https://wiki.geant.org/display/NETDEV/OAV+Training+Portal

Network Automation eAcademy



General Introduction Line

Training



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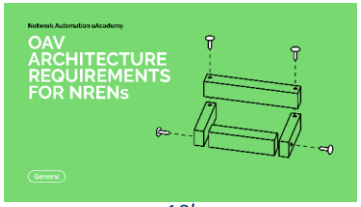

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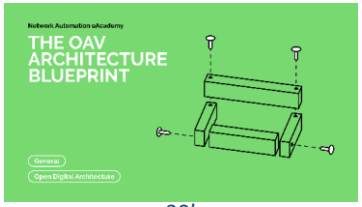

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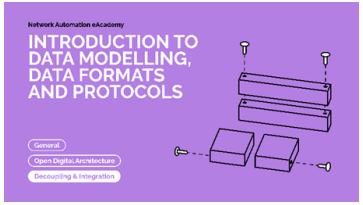

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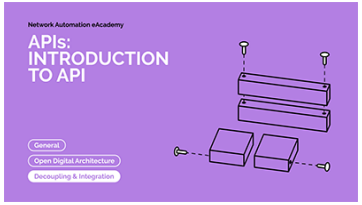

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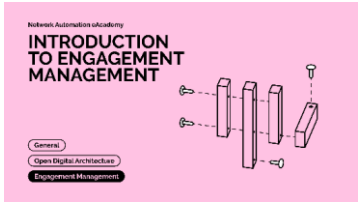

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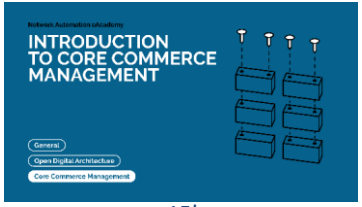

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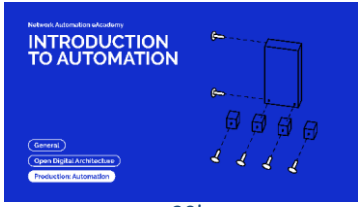

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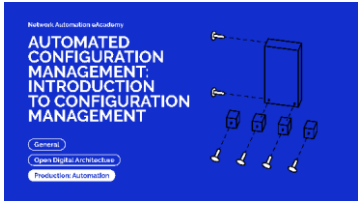

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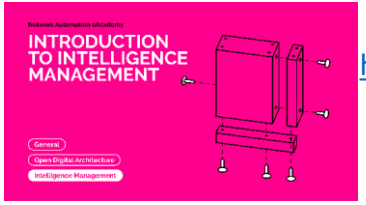

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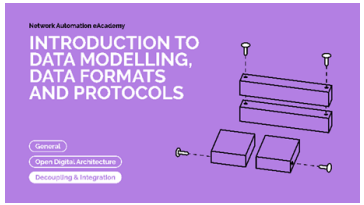
Decoupling and Integration (Data Models, Formats, Protocols, APIs)

Training



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60’

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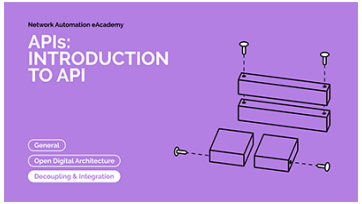
45’

4h (including installation)

2h



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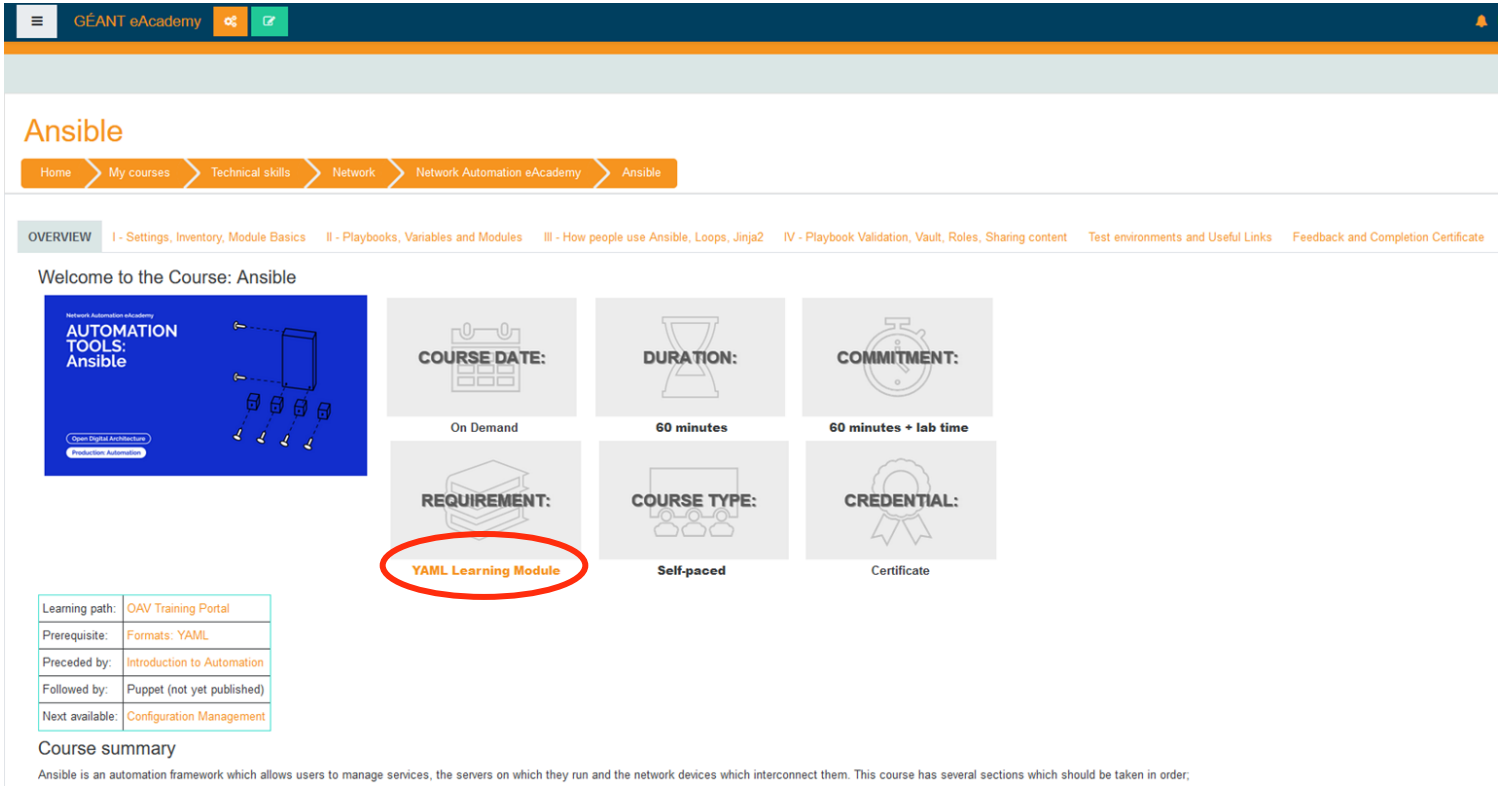
Ansible

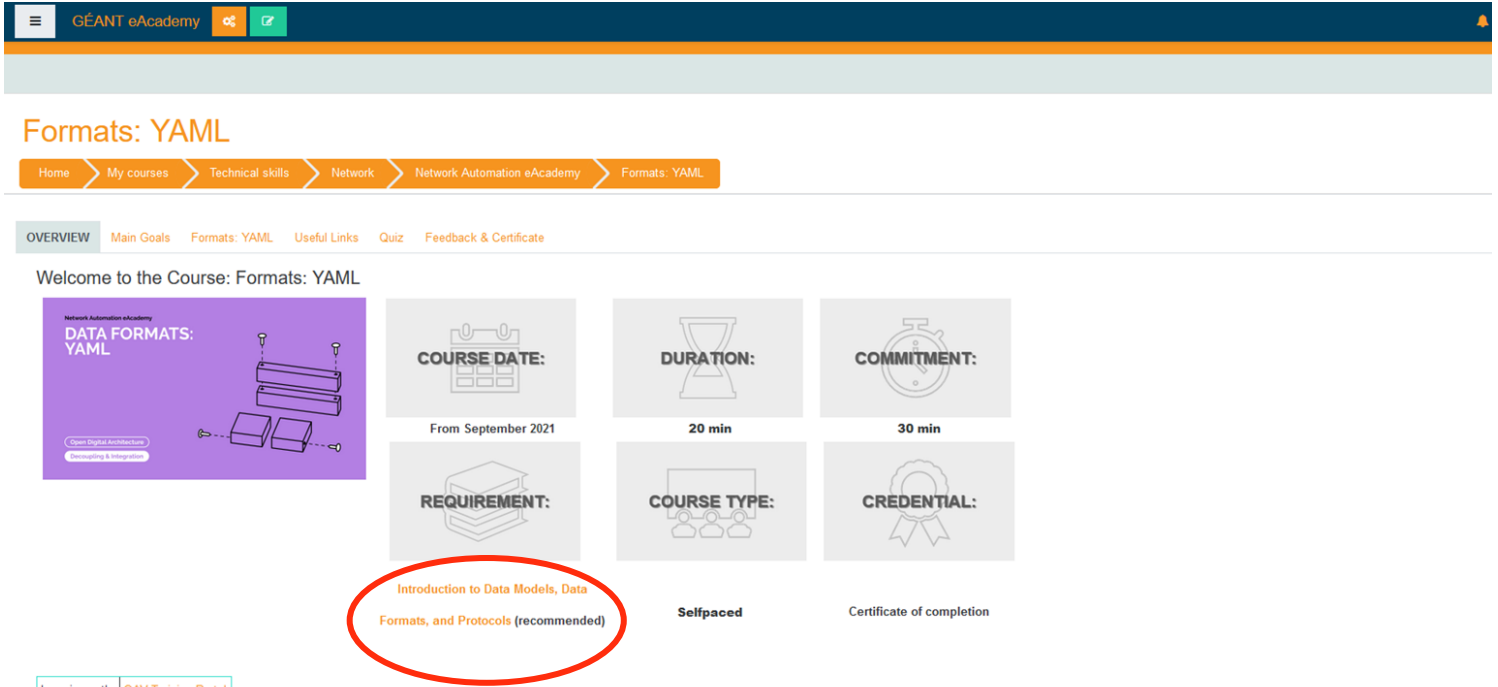
Training



https://e-academy.geant.org/moodle/course/view.php?id=120

Ansible Requirement: YAML, YAML Requirement?

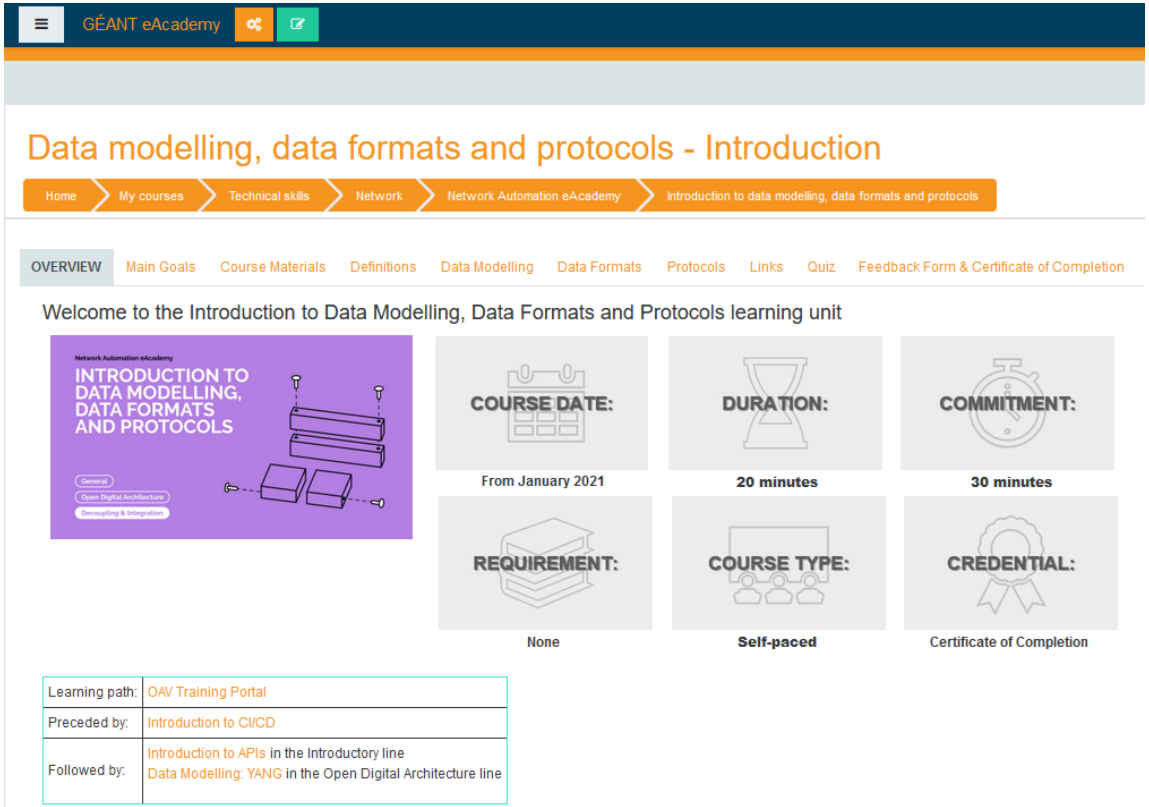
Training



https://e-academy.geant.org/moodle/course/view.php?id=129

Ansible→ YAML→ Data models, Data Formats, and Protocols

Training



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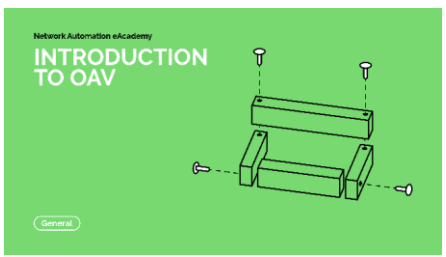
Ansible



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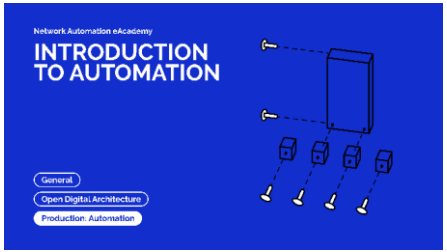

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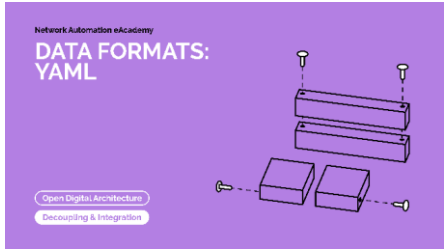


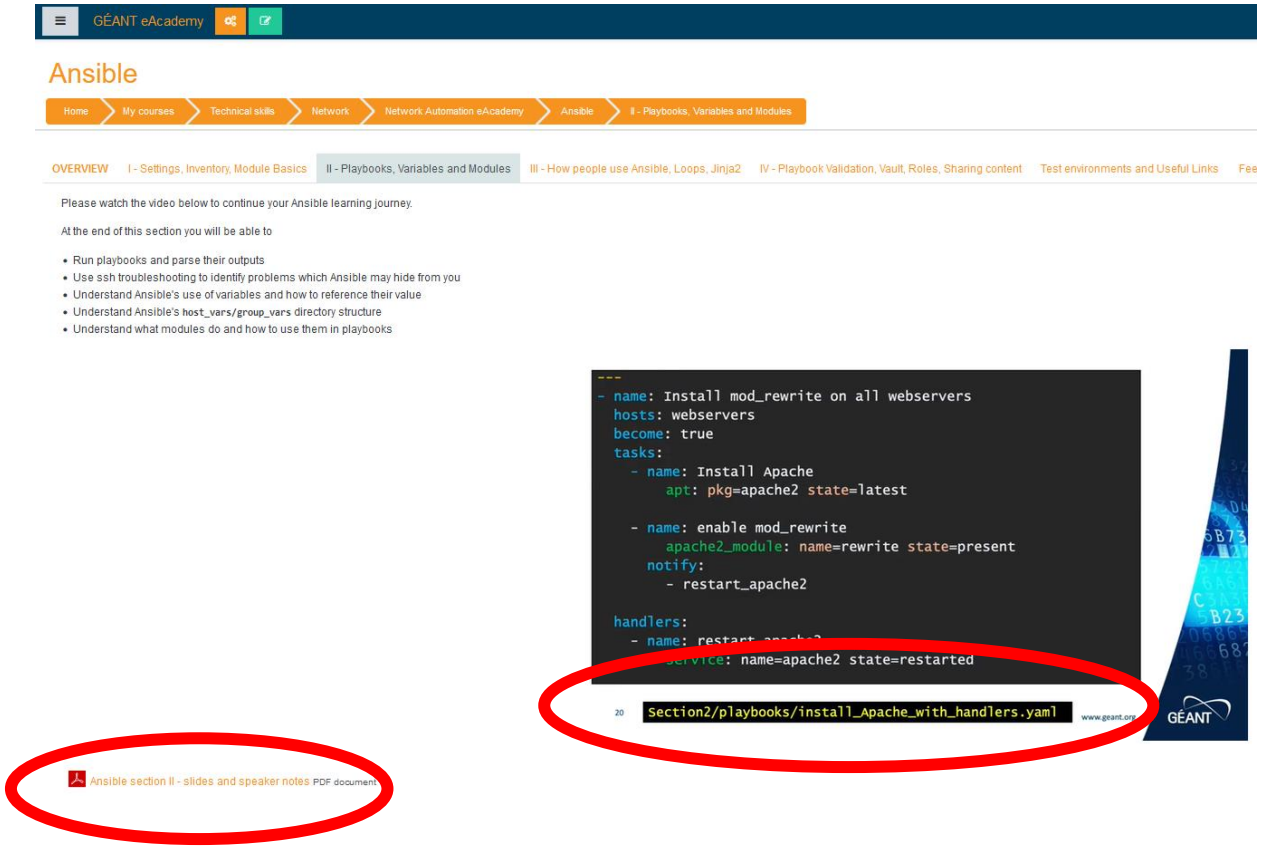
30’

60’ + lab time

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

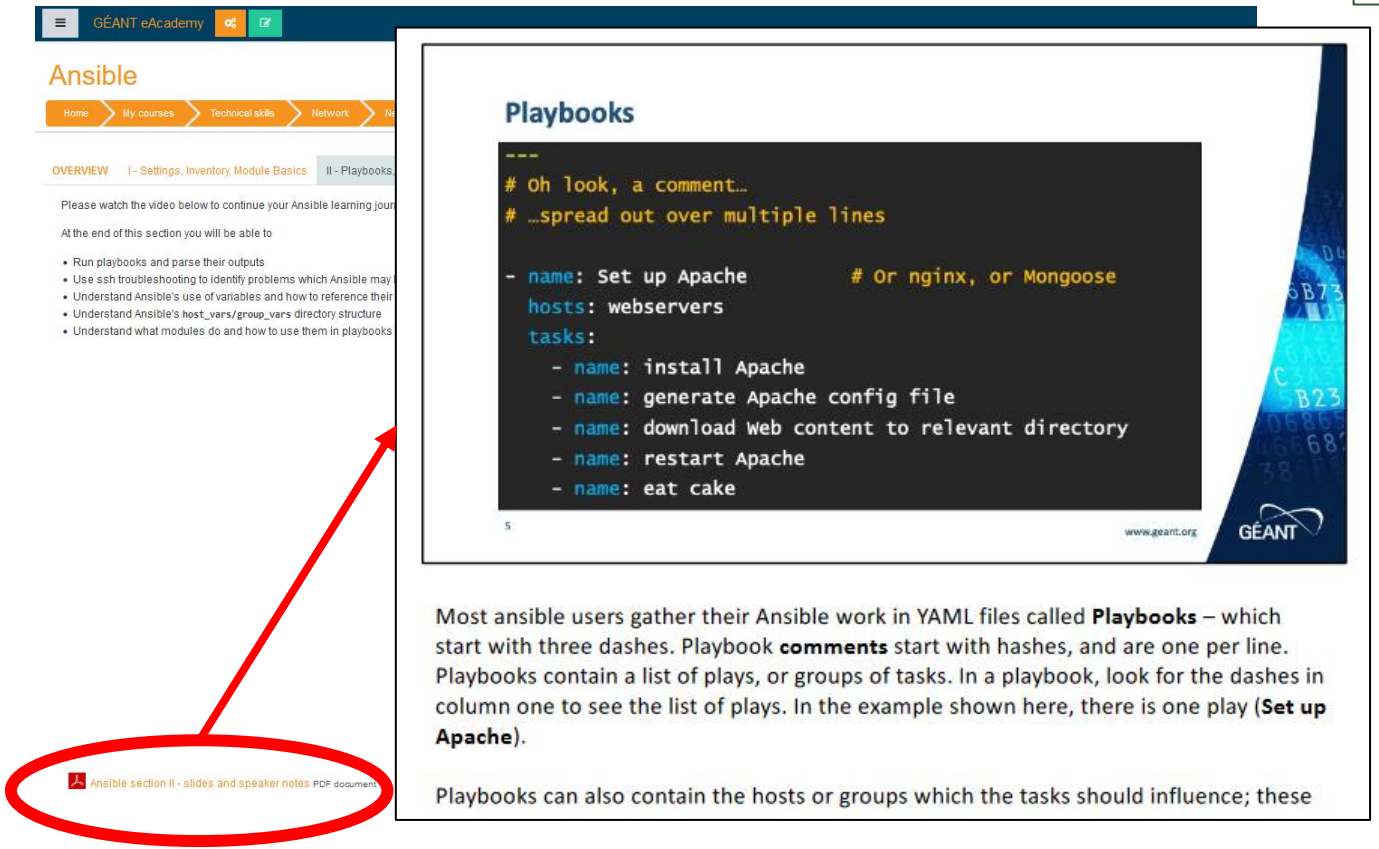
Ansible: Video with Subtitles

Training



Ansible: Slides with Speaker Notes

Training



Current Courses in the Network eAcademy – Automation

Training

Introduction

- **OAV - Introduction** (30')
- **OAV Architecture Requirements for NRENS** (10')
- **The OAV Architecture Blueprint** (30')

DevOps

- **Introduction to CI/CD** (15')
- **Version control: Gitlab** (40')
- **Version control: GitHub** (2h)
- **CI/CD: Jenkins** (5h)
- **CI/CD: GitlabCI** (40')

TM Forum Open Digital Architecture

Decoupling & Integration

- **Introduction to Data Modelling, Data Formats, and Protocols** (30')
- **Data Modelling: YANG** (10')
- **Formats: XML** (60')
- **Formats: YAML** (30')
- **Formats: JSON** (45')
- **Protocols: NETCONF** (4 h - including installation)
- **Introduction to API** (45')
- **Protocols: RESTCONF** (2h)

Engagement Management

- **Introduction to Engagement Management** (15')

Party Management

- **Introduction to Party Management** (15')

Core Commerce Management

- **Introduction to Core Commerce Management** (15')

Production

- **Introduction to Production** (30')
- **Introduction to Virtualisation** (30')
- **Container-Based Virtualisation: Docker / Swarm** (3h)
- **Container-Based Virtualisation: Kubernetes** (4h - including lab)
- **Introduction to Automation** (30')
- **Automation Tools: Ansible** (60'+lab time)
- **Automation Tools: Python** (90')
- **Introduction to Configuration Management** (20')
- **Introduction to Orchestration** (30')
- **Orchestration: NSO** (6h - including lab)

Intelligence Management

- **Introduction to Intelligence Management** (15')

Data Analytics

- **Big Data Storage** (1.5h)
- **Elasticsearch** (30')

OAV Realisation

- **Towards Intelligent Networks** (30')

ADDITIONAL READING

Architecture Mappings

NREN use cases

- **CARNET**
- **CYNET**
- **GÉANT**
- **GRNET**
- **HEAnet**
- **PIONIER**
- **SURFNET**

other use cases

- **NMaaS**

Architectures

- **Standards & Common Architectures**
- **TM Forum ODA**
- **SPA**
- **MEF**
- **ETSI-OSM**
- **ETSI-ZSM**
- **ONAP**
- **5G 3GPP**
- **GVM**
- **SENSE**
- **TALENT**
- **EOSC**
- **OpenBaton**

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

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- **OpenBaton**

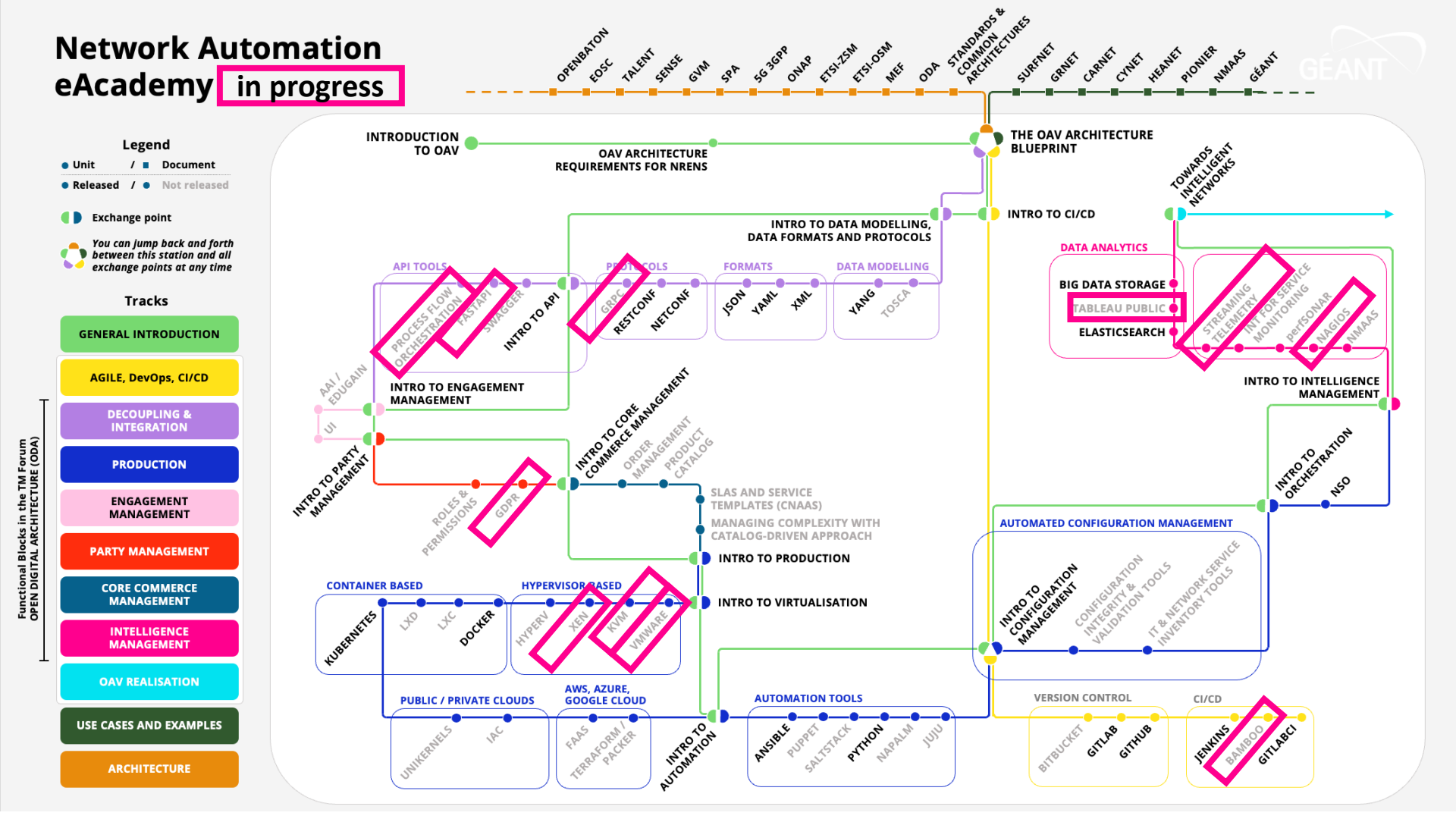
https://wiki.geant.org/display/NETDEV/OAV+Training+Portal

Practical Examples

Training

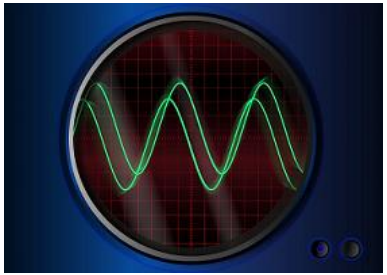
- Ansible:
  - Git repository with the examples in the unit.
  - Mini-Lab: Vagrant testing environment with a Unix server and a JunOS box.
- NETCONF:
  - Installation guide with a virtual environment in GNS3.
  - Adding a static route to a router, step-by-step.
- NSO:
  - Installation of free trial version.
  - Implementing a Radius server configuration over multiple devices.
  - Deploying an ACL on multiple devices, and/or interfaces on a device.

Network Automation eAcademy in progress

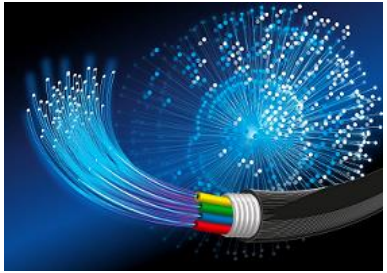


Currently Working on Training for:

Training



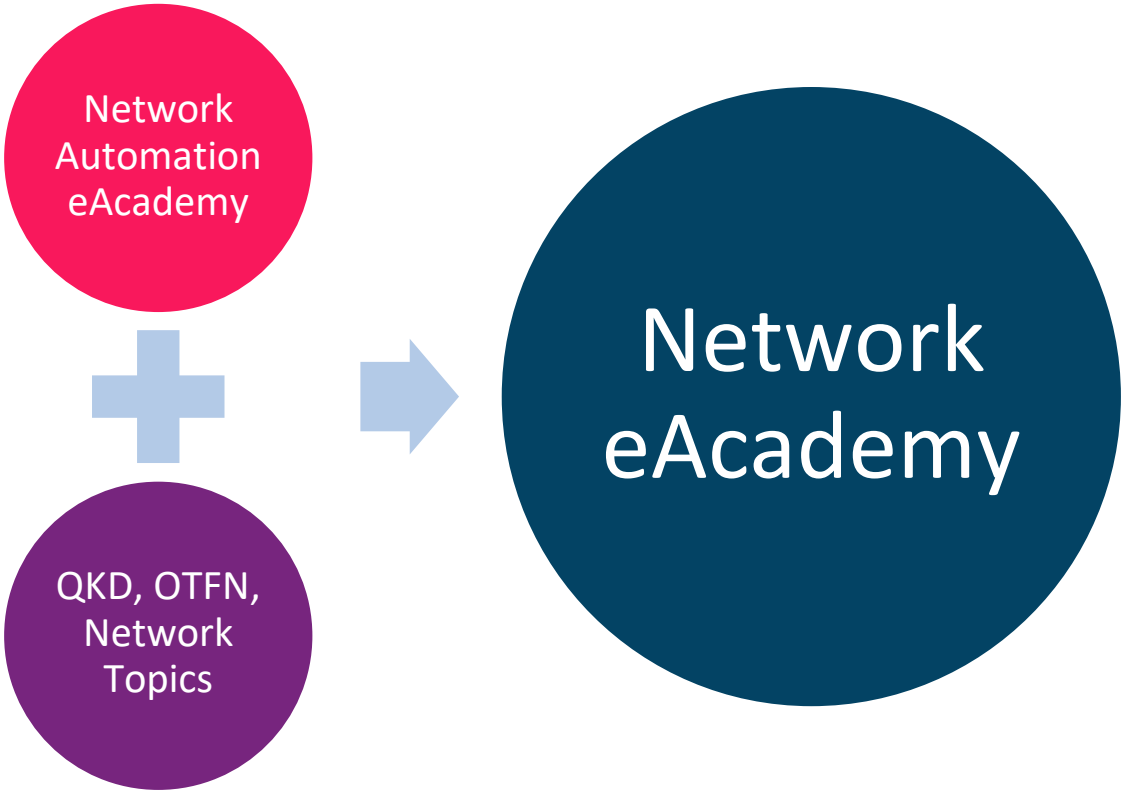
[Optical Time and Frequency Networks (OTFN)]



[Quantum Technologies]

The Network eAcademy

Network eAcademy



Current Courses in the Network eAcademy – Quantum

Training

Quantum Algebra: Bloch Sphere

Course creator: Peter Kaufmann

Quantum Algebra: Entanglement Swapping

Course creator: Peter Kaufmann

Quantum Algebra: Mathematical Operators

Course creator: Peter Kaufmann

Quantum Algebra: Operator Multiplication: Variants

Course creator: Peter Kaufmann

Quantum Algebra: QuBit Entanglement

Course creator: Peter Kaufmann

Quantum Algebra: QuBits

Course creator: Peter Kaufmann

Quantum Algebra: Teleportation

Quantum Computers

Quantum Computing and Post-Quantum Cryptography

Currently working on – Quantum in progress

Training

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Course creator: Peter Kaufmann

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Quantum Algebra: QuBit Entanglement

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Quantum Algebra: QuBits

Course creator: Peter Kaufmann

Quantum Algebra: Teleportation

Quantum Computers

Quantum Computing and Post-Quantum Cryptography

Terminology and Glossary of OAV Terms

Terminology

- Need for an agreement on common terminology.
- The idea is to have a common ground of understanding.
- Published version 2.0 with additional terms about **AI** and **Maturity Model**
- Accepted by the GNA-G Automation Working Group

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Glossary

OAV Terms	Definition and reference
AIOps	***AIOps is (the usage of) Artificial Intelligence for IT Operations. It combines big data and machine learning to automate IT operations processes, including event correlation, anomaly detection and causality determination.*** • https://www.gartner.com/en/information-technology/glossary/aiops-artificial-intelligence-operations
AI-powered Virtual Agent (AIVA)	***An AI-powered Virtual Agent is an animated virtual character, more complex than a chatbot, that makes use of technologies like machine learning and natural language processing (NLP). This allows it to actively participate in a conversation, acting more like a human.*** • **Reference(s)**: based on https://www.ringcentral.com/virtual-agent.html and TM Forum AI Fundamentals course [TMF_AIF] and TM Forum "AI and its pivotal role in transforming operations" report and webinar [TMF_AI]
API (Application Programming Interface)	***An API is a set of commands, functions, protocols, and objects that programmers can use to create software or interact with an external system. Any data can be shared with an application program interface.***

https://wiki.geant.org/display/NETDEV/OAV+Terminology

OAV Maturity Model

Maturity Model

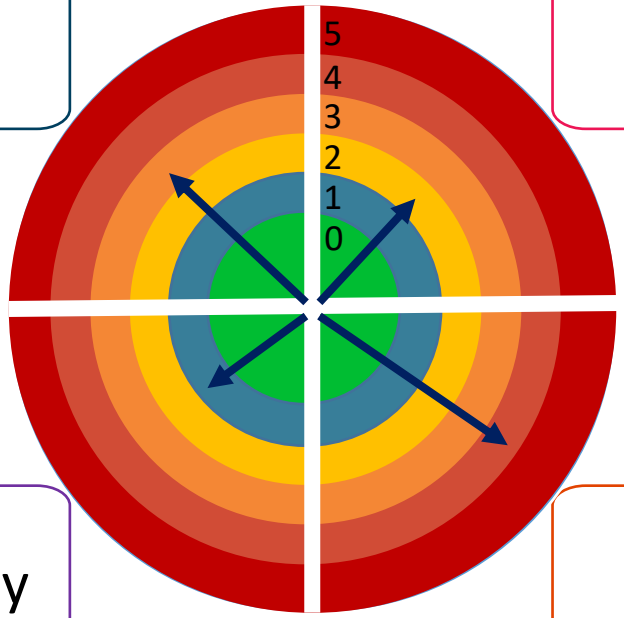
Measure	Measure the current OAV capabilities in a meaningful way
Identify	Enable clear identification of strengths and improvement points, be aware of threats and opportunities
Prioritise	Help prioritise what to do in order to advance and improve
Journey	Identify gaps between the current and future state and how to get there

OAV Maturity Model - Dimensions

Maturity Model

Architecture & Technology

Processes & Services



Vision & Strategy

People & Organisation

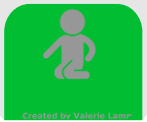
OAV Maturity Model - Stages

Maturity Model

Level 0

Sit

None



Level 1

Crawl

Ad Hoc

Level 2

Walk

Use Case / Project-based / Reactive

Level 3

Run

Integrated

Level 4

Fly

Proactive

Level 5

Energise

Self-*

The Maturity Model

Maturity Model

Survey (31 questions)*:
https://www.surveymonkey.com/r/SPYDQVB

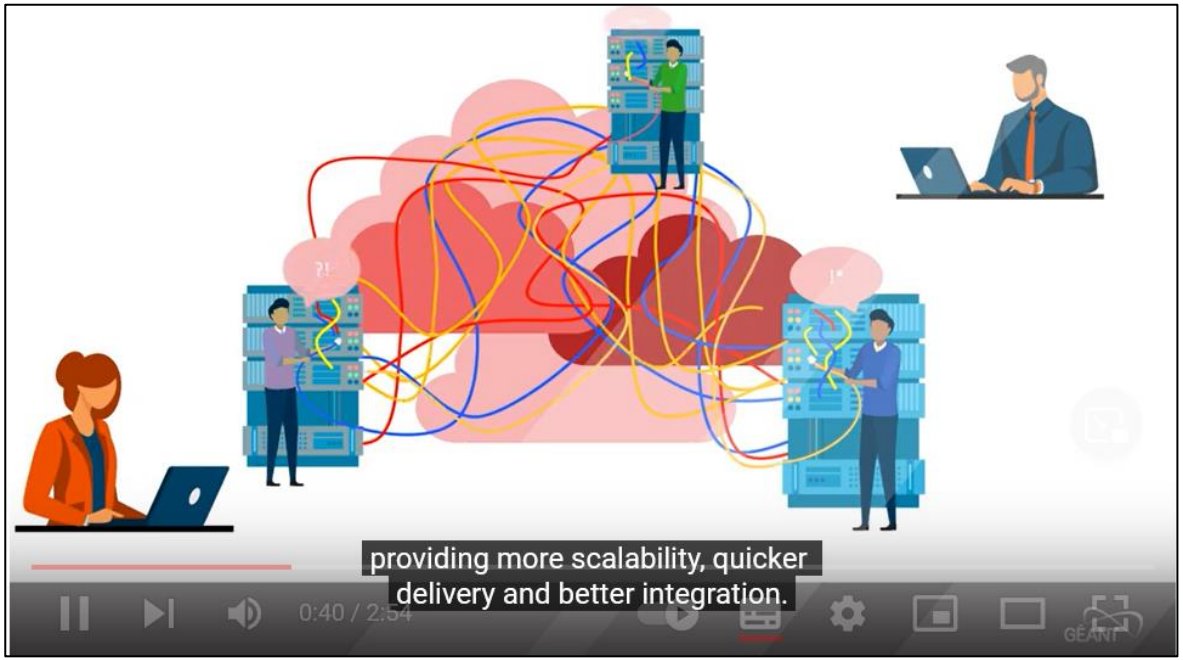
Information to help you check your progress through stages and dimensions:
https://wiki.geant.org/display/NETDEV/OAV+Maturity+Model

Presentations of the OAV MM Infoshare:
https://events.geant.org/e/OAV-MM

* Data is used for analytical purposes only (we don't publish data for individual institutions)
The report is sent to the person defined in the survey

Promoting Orchestration, Automation and Virtualisation (I)

Promotion

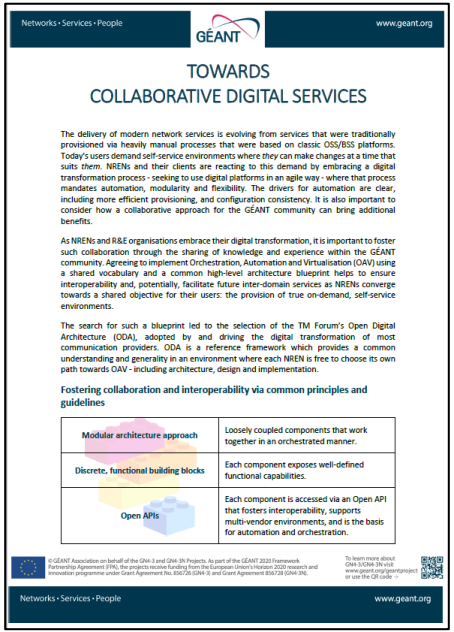


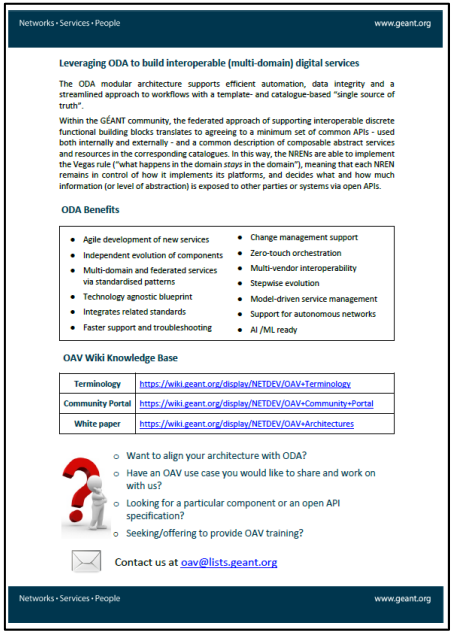
Towards Service Automation for Research and Education

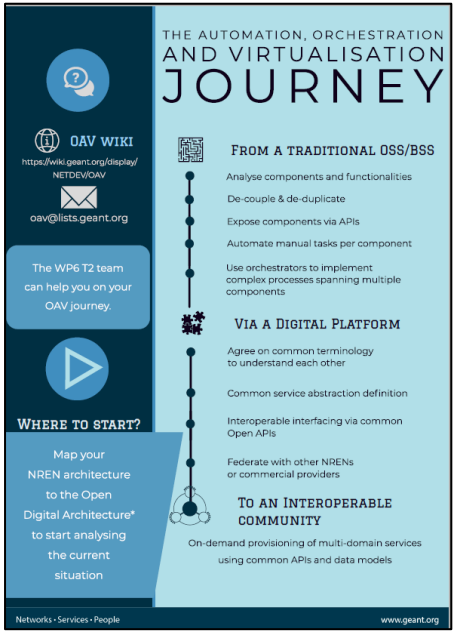
Video in the GÉANT TV channel:
https://youtu.be/Q5Wg1Qnqybg

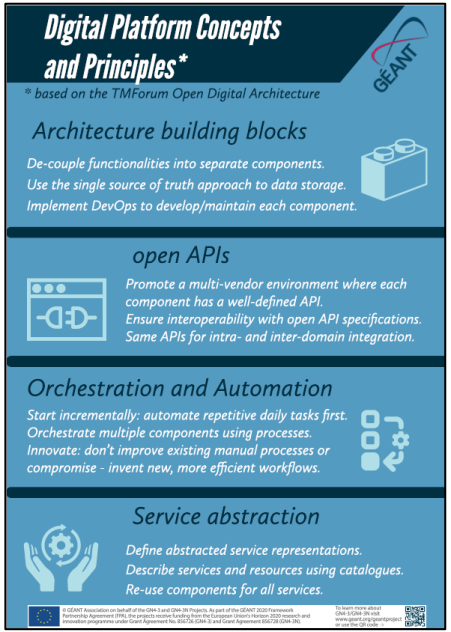
Promoting Orchestration, Automation and Virtualisation (II)

Promotion









Towards Collaborative Digital Services

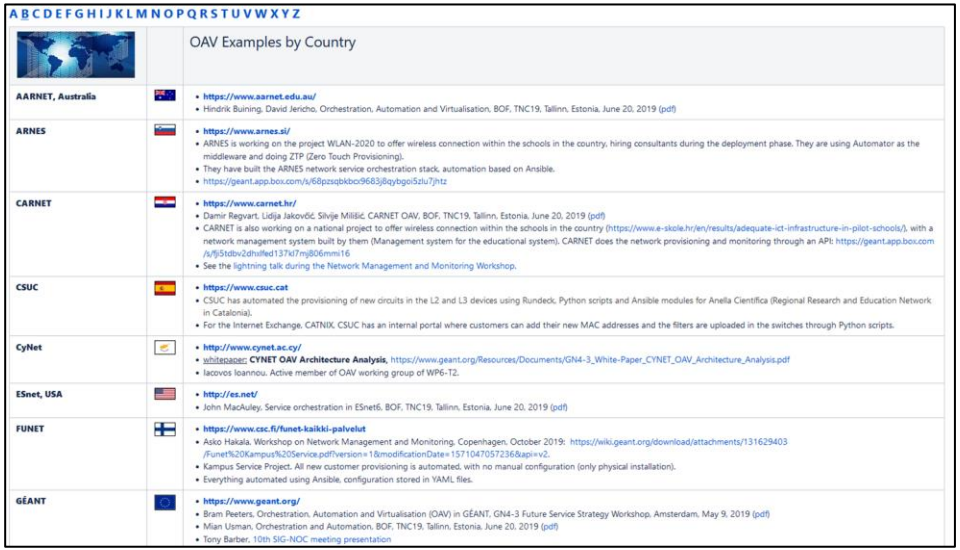
Pamphlet and Infographic:

https://www.geant.org/Resources/Documents/OAV_Arch_text_and_infographics_new_links.pdf

Wiki

Wiki

- Community Portal
- Sections for OAV:
  - Architecture
  - Training
  - Maturity Model
  - Terminology
  - Literature
  - Examples of usage: CNaaS, DTN
  - Dissemination: Deliverables, Infoshares, Presentations, Articles…



With Many Thanks to our Trainers!

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Iacovos Ioannou (CyNet)	Your name here?

And the WPL, the GLAD team and the Communications team at GÉANT!

Contact us at network-eacademy@lists.geant.org

For any questions, the R&E community can join us once a month.

Thank You!

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