Network eAcademy

Maria Isabel Gandia Carriedo, CSUC/RedIRIS

EURO-IX Meeting
12th-14th May 2024, Heraklion, Greece

Public (PU)

Maria Isabel in ~~a~~ three Nutshells

CATNIX
Catalonia Neutral Internet Exchange

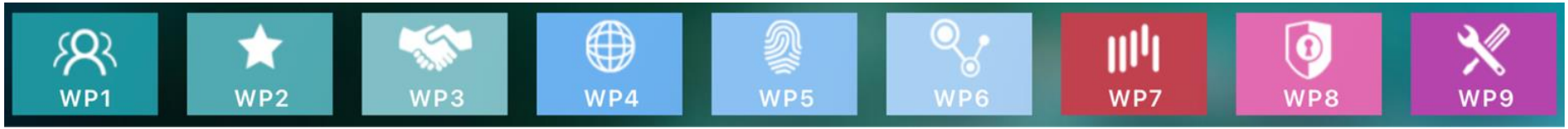
ANELLA CIENTÍFICA

GÉANT
Networks • Services • People

Introduction - The GÉANT Project

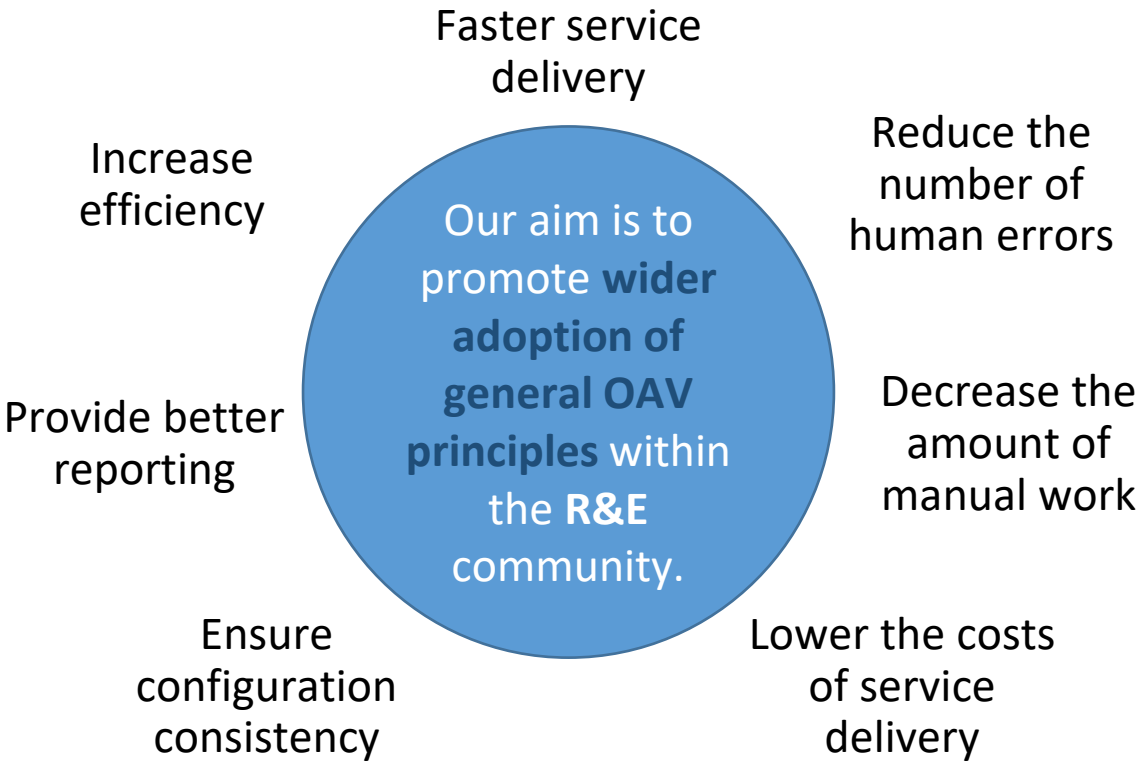
GÉANT is the collaboration of European National Research and Education Networks (NRENs) on delivering an information ecosystem of infrastructure and services to advance research, education and innovation on a global scale:

- 50 million users
- 500 contributors from 37 R&E partners
- 9 projects so far
- Current project generation: GN5-1



WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9
Project Management	Marcoms, Events and Policy Management	User and Stakeholder Engagement	Above-the-net services	Trust and Identity Services Evolution and Delivery	Network Development	Network Core Infrastructure and Core Service Evolution and Operations	Security	Operations support

OAV: Orchestration, Automation and Virtualisation



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

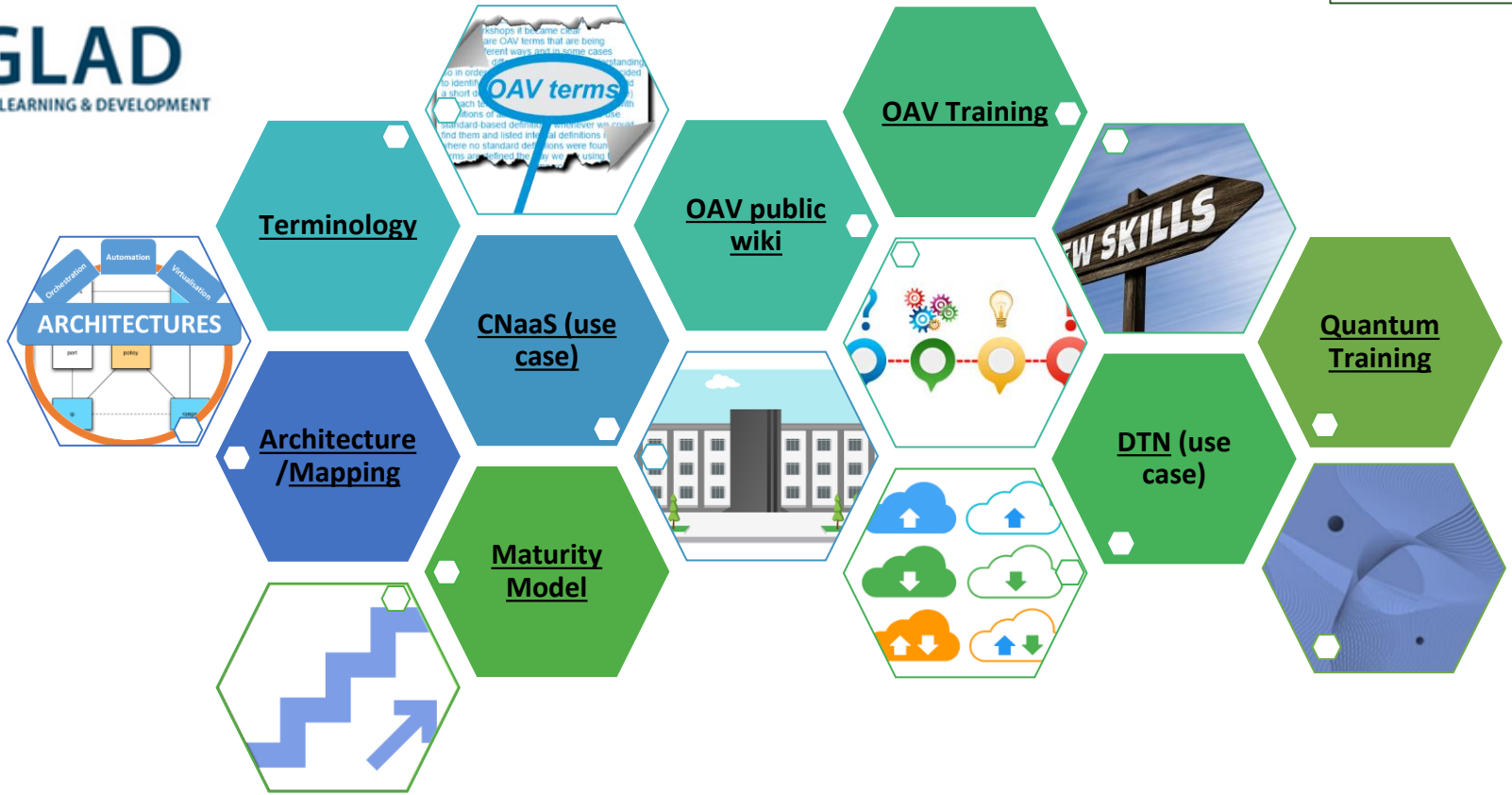
Feedback from the OAV Survey to the NRENs (published in Sep 19):
https://www.geant.org/Projects/GEANT_Project_GN4-3/GN43_deliverables/D6-2_Automation-and-Orchestration-of-Services-in-the-GEANT-Community.pdf

Network eAcademy

Network eAcademy

Powered by:

GLAD
GÉANT LEARNING & DEVELOPMENT



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

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

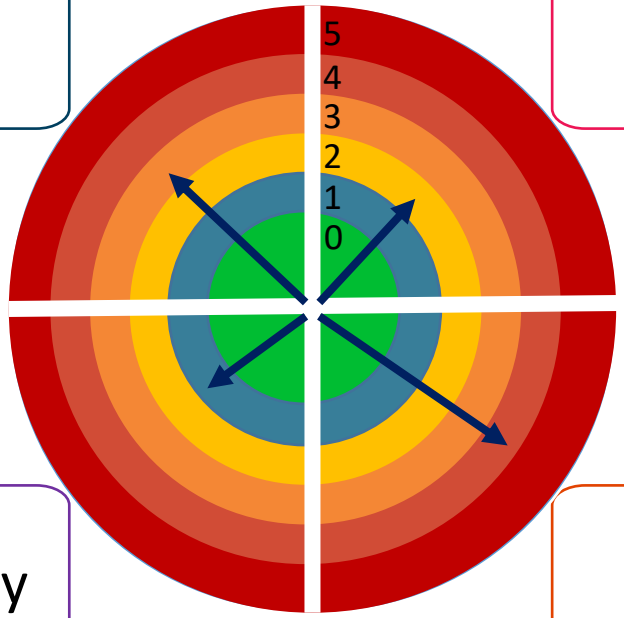
Information on stages and dimensions: https://wiki.geant.org/display/NETDEV/OAV+Maturity+Model

OAV Maturity Model - Dimensions

Maturity Model

Architecture & Technology

Processes & Services



Vision & Strategy

People & Organisation

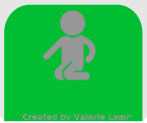
OAV Maturity Model - Stages

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

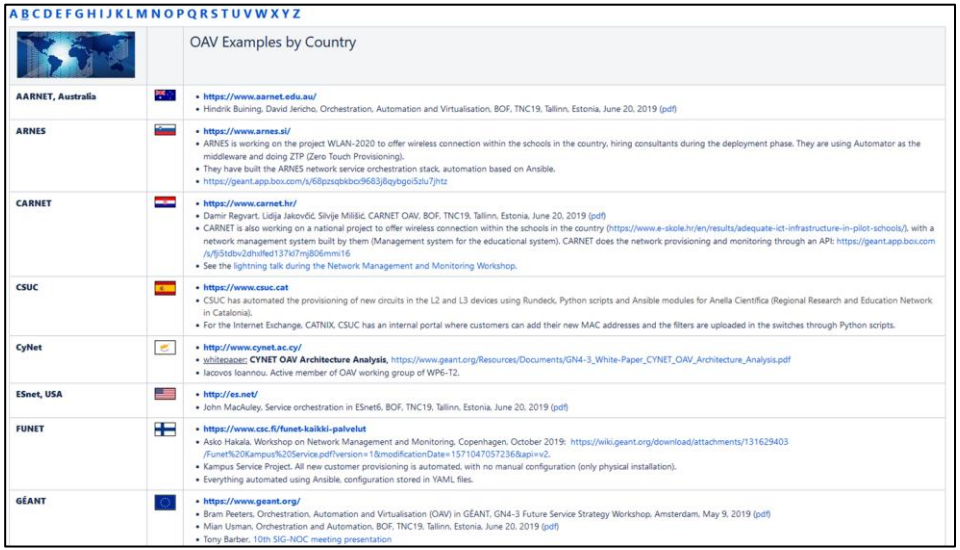
Energise

Self-*

Wiki

Wiki

- Community Portal
- Sections for OAV:
  - Architecture
  - Training
  - Maturity Model
  - Terminology
  - Literature
  - Dissemination: Deliverables, Infoshares, Presentations, Articles...



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

OAV Examples by Country

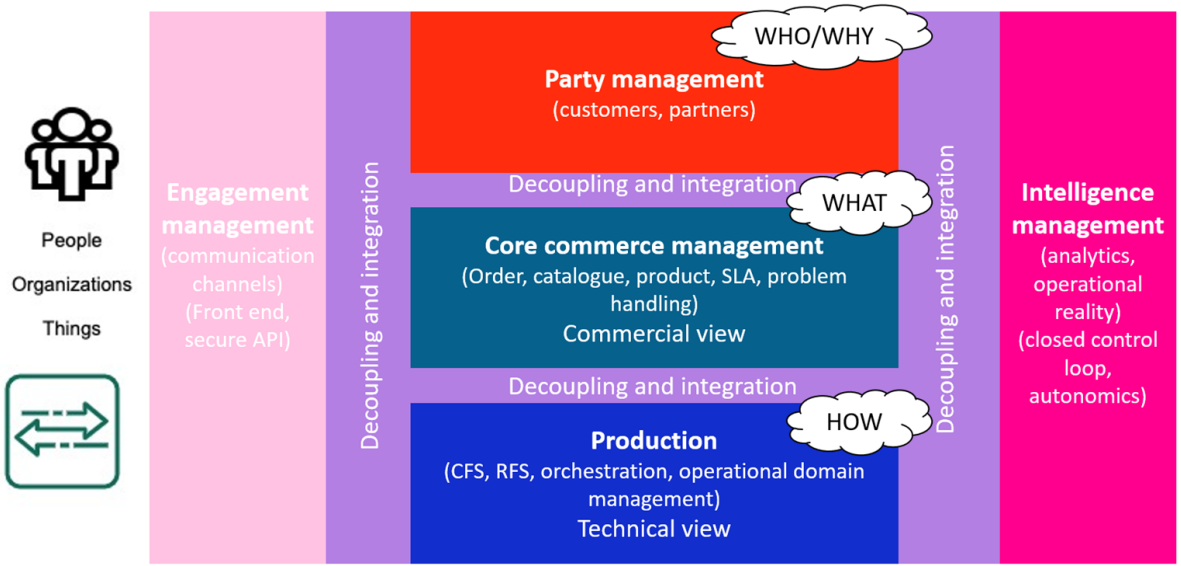
AARNET, Australia	• **https://www.aarnet.edu.au/** • Hindrik Buining, David Jericho, Orchestration, Automation and Virtualisation, BOF, TNC19, Tallinn, Estonia, June 20, 2019 (pdf)
ARNES	• **https://www.arnes.si/** • ARNES is working on the project WLAN-2020 to offer wireless connection within the schools in the country, hiring consultants during the deployment phase. They are using Automator as the middleware and doing ZTP (Zero Touch Provisioning). • They have built the ARNES network service orchestration stack, automation based on Ansible. • https://geant.app.box.com/s/68pzsqbkbcx9683j8qybgoi5zlu7jhtz
CARNET	• **https://www.carnet.hr/** • Damir Regvart, Lidija Jakovčić, Silvije Milišić, CARNET OAV, BOF, TNC19, Tallinn, Estonia, June 20, 2019 (pdf) • CARNET is also working on a national project to offer wireless connection within the schools in the country (https://www.e-skole.hr/en/results/adequate-ict-infrastructure-in-pilot-schools/), with a network management system built by them (Management system for the educational system). CARNET does the network provisioning and monitoring through an API: https://geant.app.box.com/s/fji5tdbv2dhxlfed137kl7mj806mmi16 • See the lightning talk during the Network Management and Monitoring Workshop.
CSUC	• **https://www.csuc.cat** • CSUC has automated the provisioning of new circuits in the L2 and L3 devices using Rundeck, Python scripts and Ansible modules for Anella Científica (Regional Research and Education Network in Catalonia). • For the Internet Exchange, CATNIX, CSUC has an internal portal where customers can add their new MAC addresses and the filters are uploaded in the switches through Python scripts.
CyNet	• **http://www.cynet.ac.cy/** • whitepaper: **CYNET OAV Architecture Analysis**, https://www.geant.org/Resources/Documents/GN4-3_White-Paper_CYNET_OAV_Architecture_Analysis.pdf • Iacovos Ioannou. Active member of OAV working group of WP6-T2.
ESnet, USA	• **http://es.net/** • John MacAuley, Service orchestration in ESnet6, BOF, TNC19, Tallinn, Estonia, June 20, 2019 (pdf)
FUNET	• **https://www.csc.fi/funet-kaikki-palvelut** • Asko Hakala, Workshop on Network Management and Monitoring, Copenhagen, October 2019: https://wiki.geant.org/download/attachments/131629403/Funet%20Kampus%20Service.pdf?version=1&modificationDate=1571047057236&api=v2. • Kampus Service Project. All new customer provisioning is automated, with no manual configuration (only physical installation). • Everything automated using Ansible, configuration stored in YAML files.
GÉANT	• **https://www.geant.org/** • Bram Peeters, Orchestration, Automation and Virtualisation (OAV) in GÉANT, GN4-3 Future Service Strategy Workshop, Amsterdam, May 9, 2019 (pdf) • Mian Usman, Orchestration and Automation, BOF, TNC19, Tallinn, Estonia, June 20, 2019 (pdf) • Tony Barber, 10th SIG-NOC meeting presentation

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:

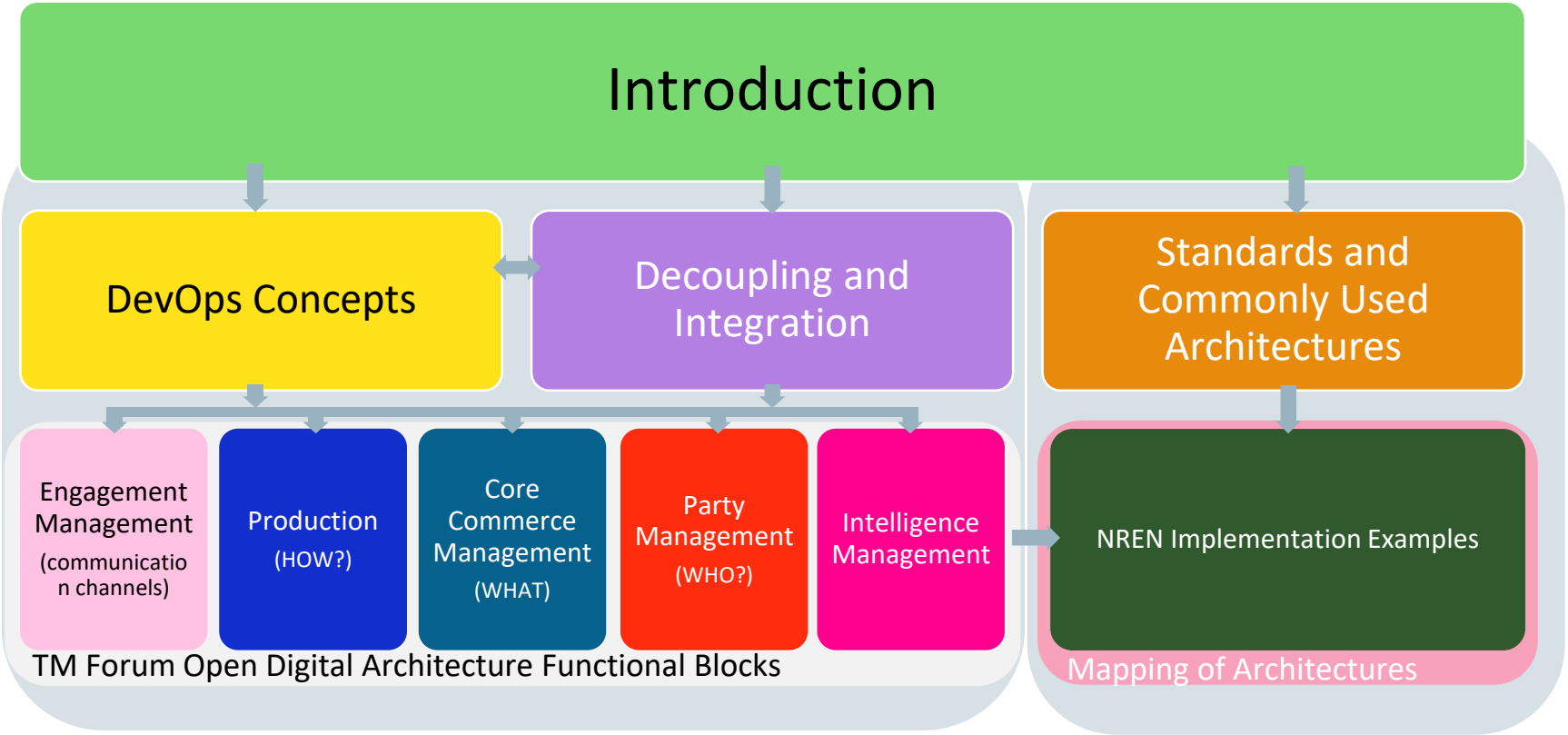
- CARNET
- CYNET
- GÉANT
- GRNET
- HEAnet
- PIONIER
- SURFNET

Platform mappings to date:

- Argus
- NMaaS
- PMP

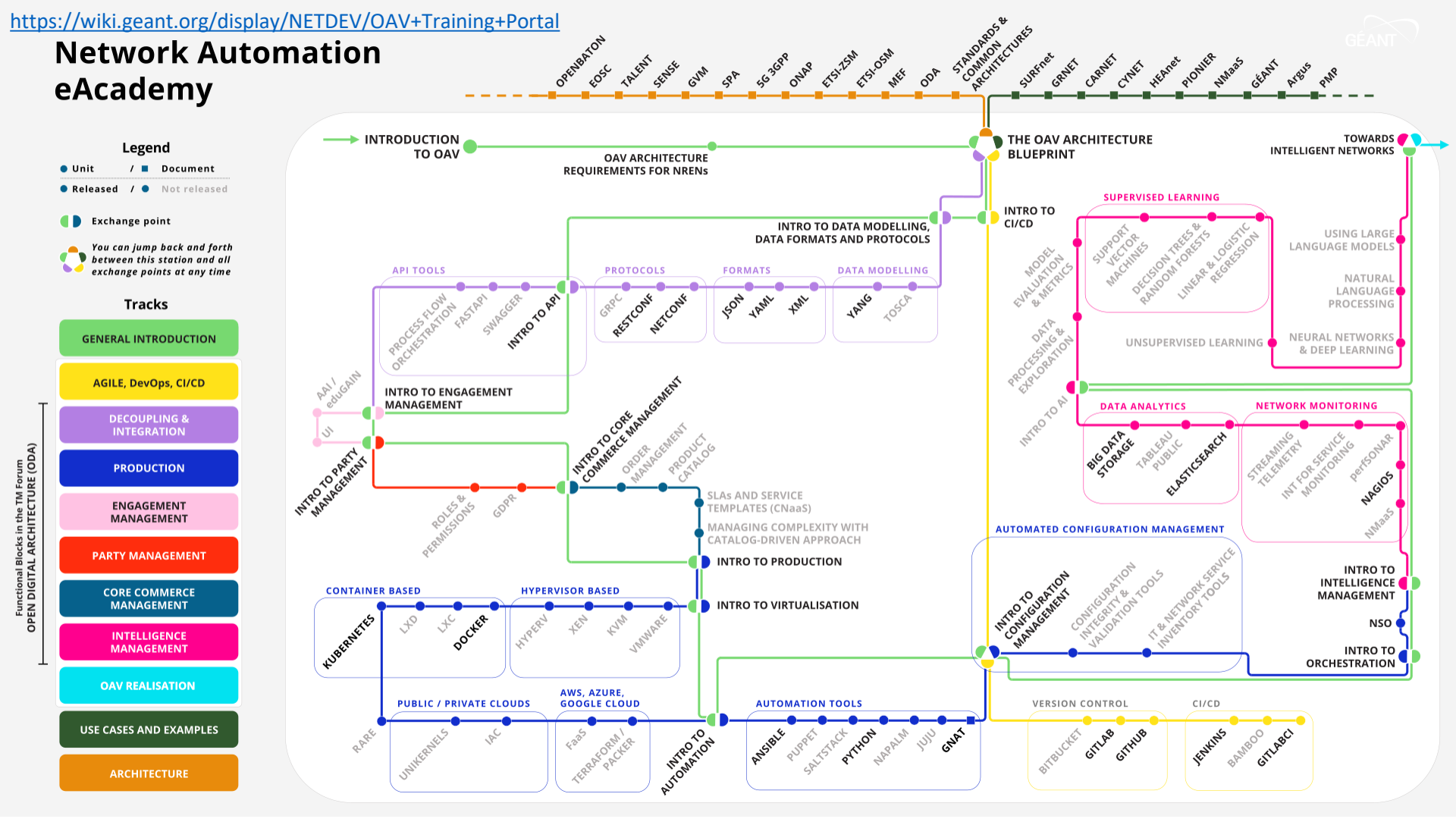
Knowledge Map for the Training

Training



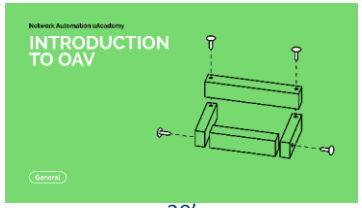
https://wiki.geant.org/display/NETDEV/OAV+Training+Portal

Network Automation eAcademy

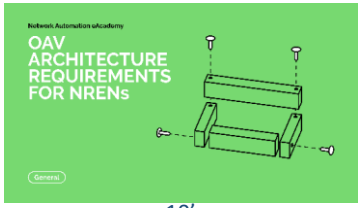


General Introduction Line

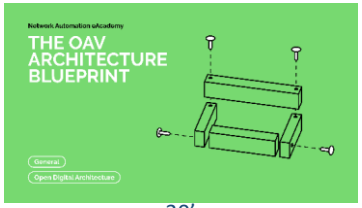
Training



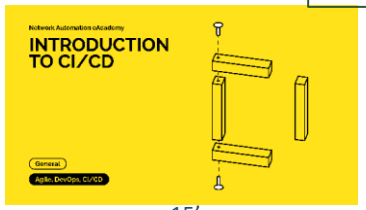
30’



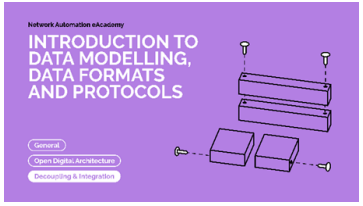
10’



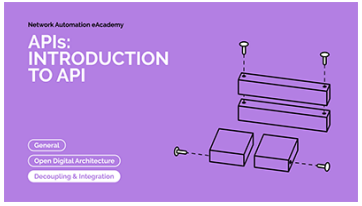
30’



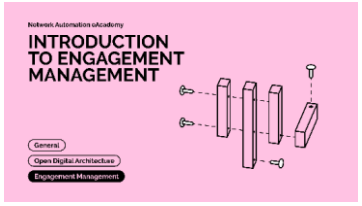
15’



30’

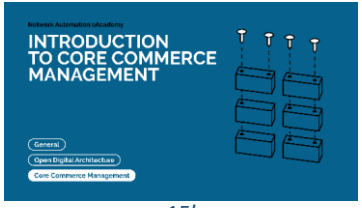


45’



15’

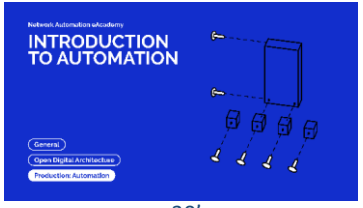
15’



15’

30’

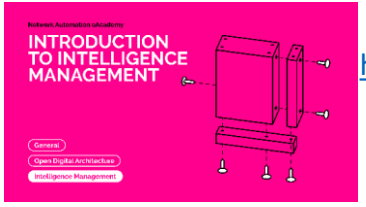
30’



30’

30’

30’



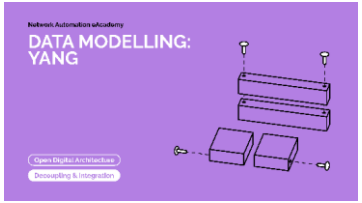
15’

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

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

Training

30’



10’

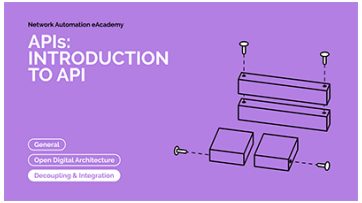
60’

30’

45’

4h (including installation)

2h

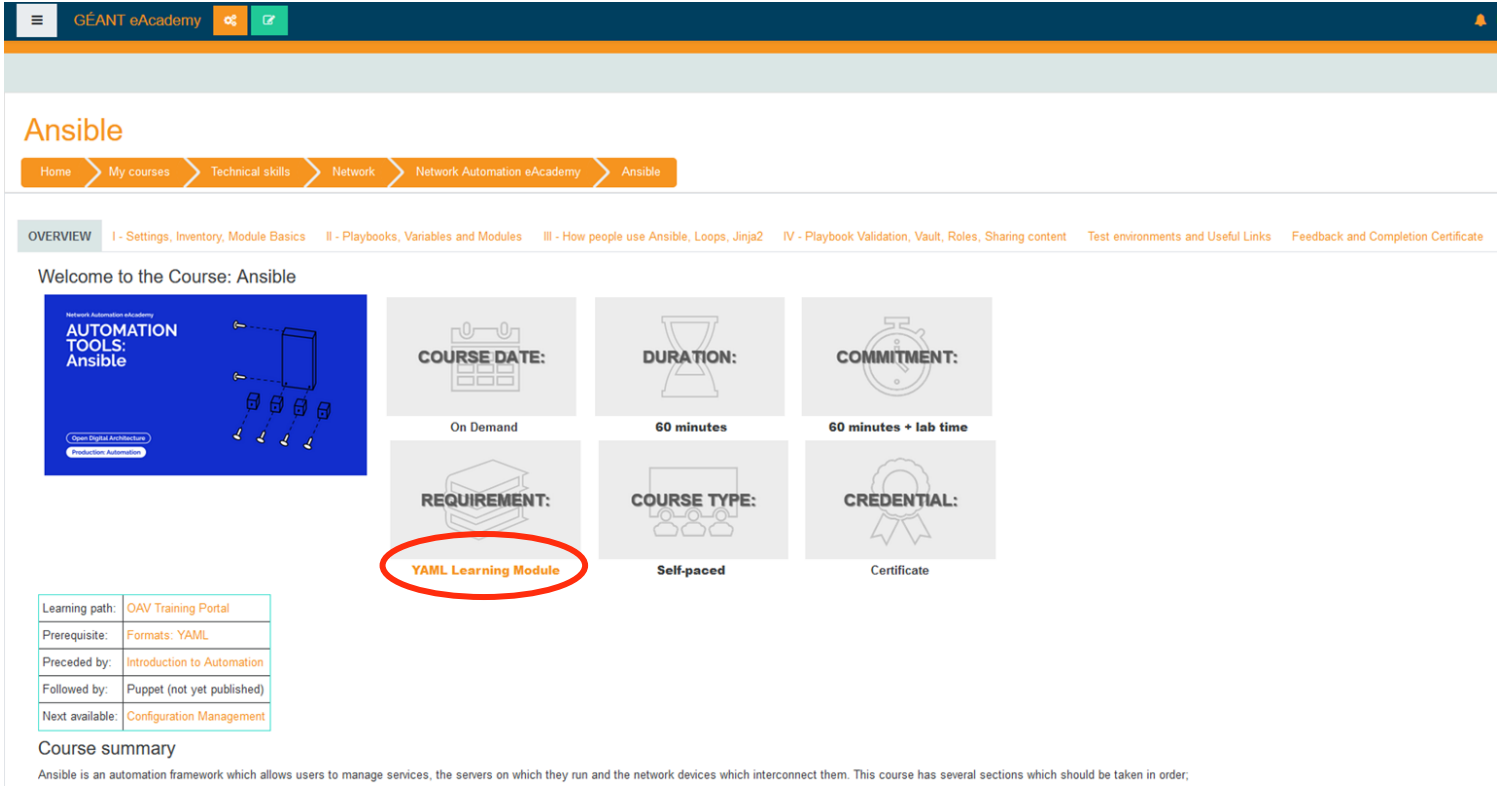


45’

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

Ansible

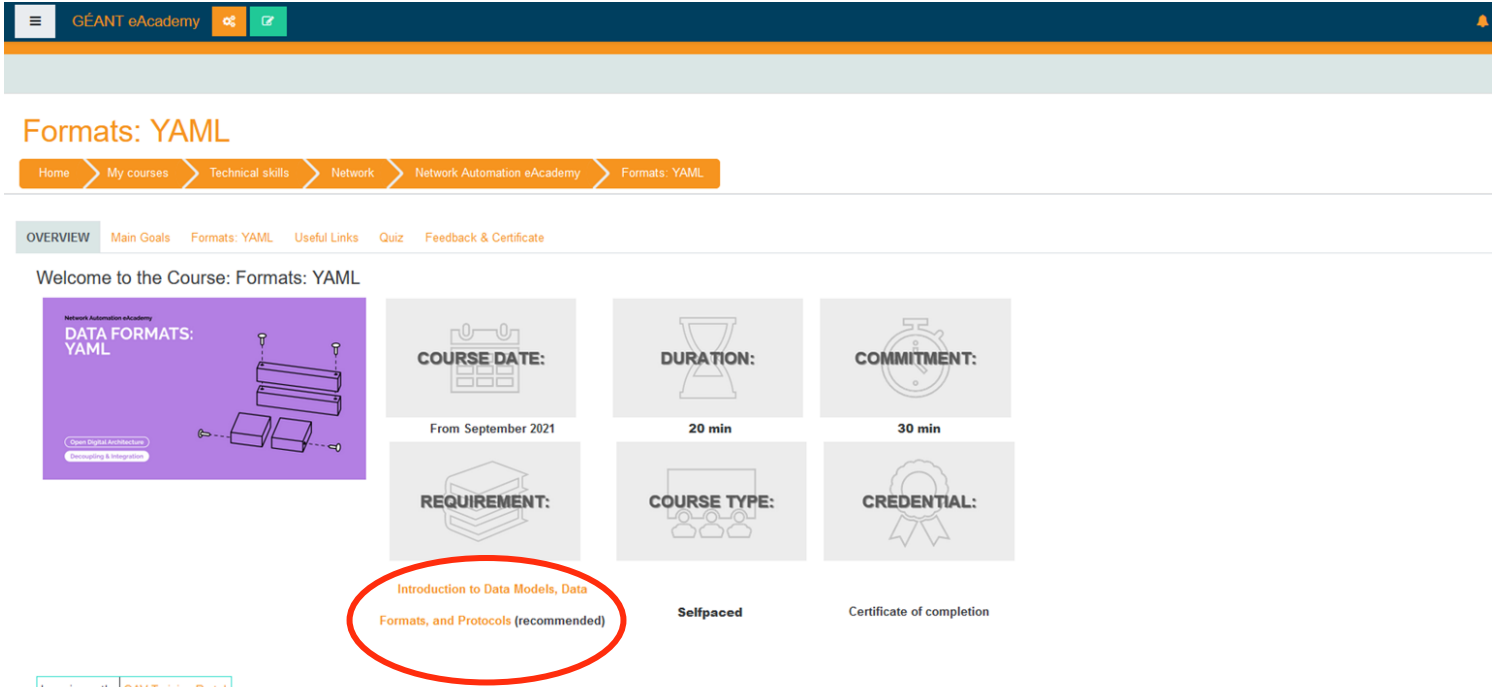
Training



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

Ansible Requirement: YAML, YAML Requirement?

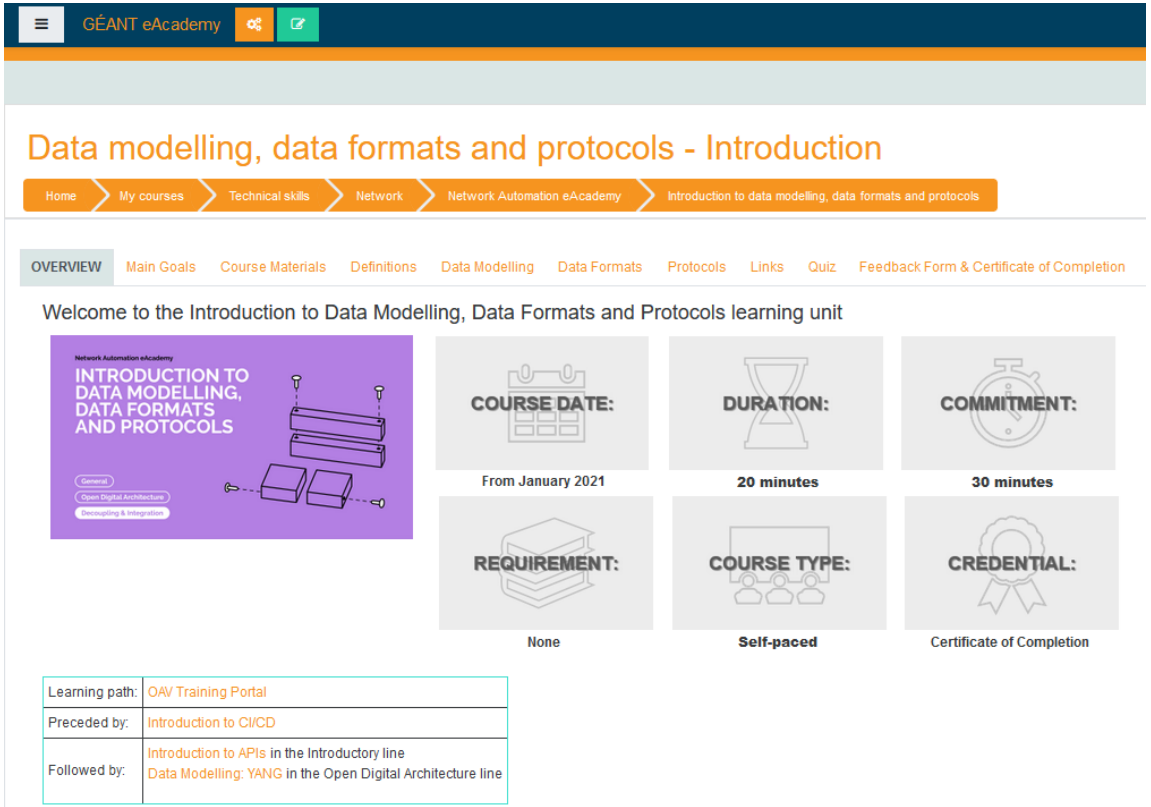
Training



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

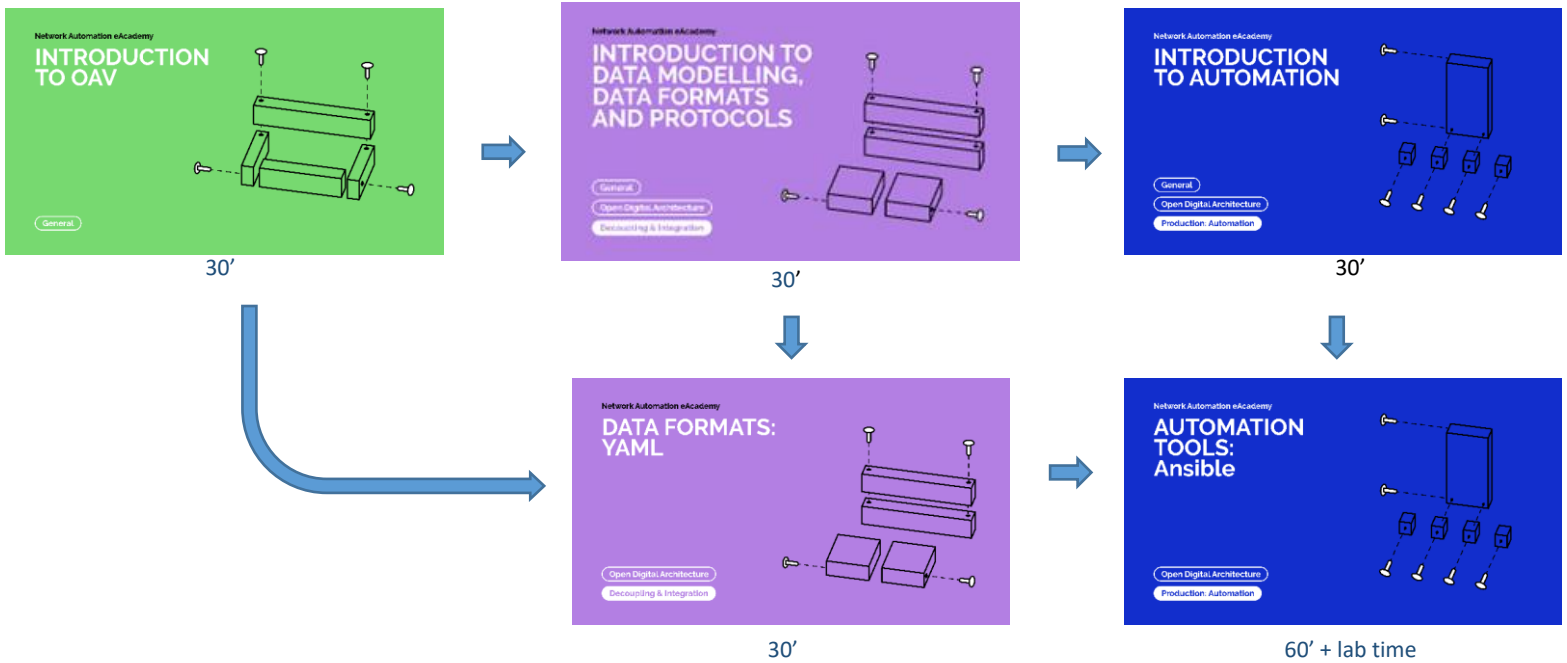
Ansible→ YAML→ Data models, Data Formats, and Protocols

Training



https://e-academy.geant.org/moodle/course/view.php?id=61

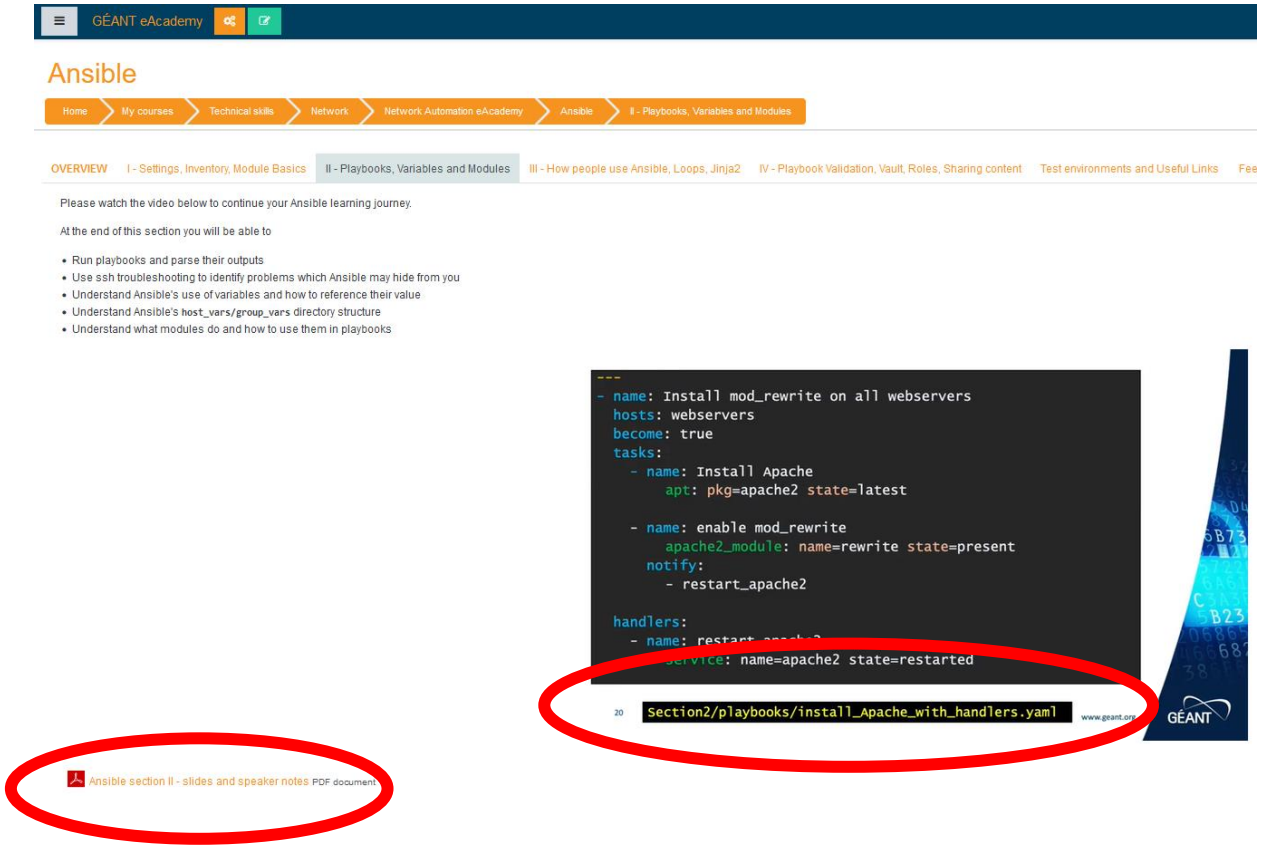
Ansible



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

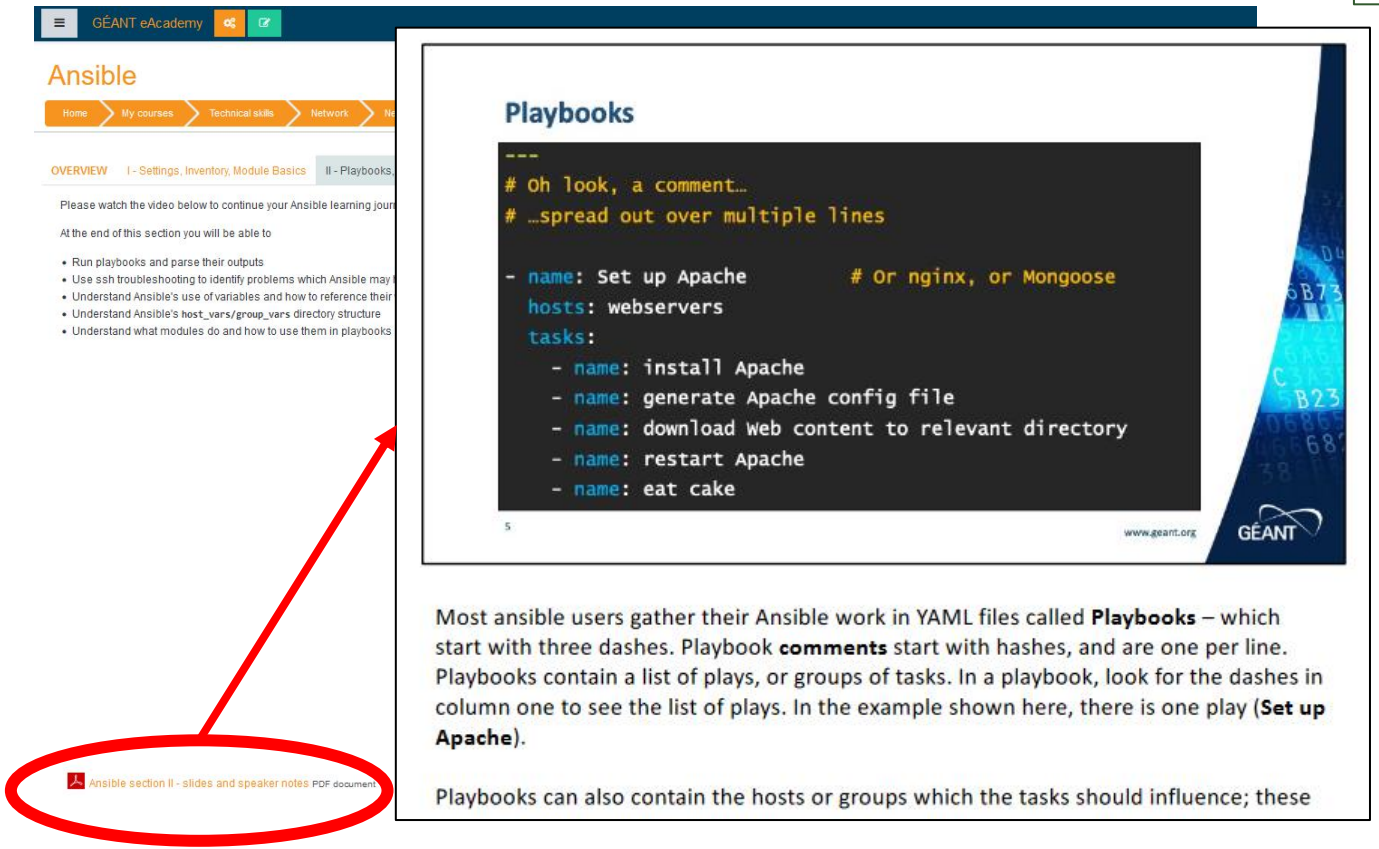
Ansible: Video with Subtitles

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')

CC BY-NC-SA
license
eduGAIN access
(or social media)

CC BY NC SA

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

- Argus
- NMaaS
- New: PMP
- SPA

Architectures

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

External Collaborations

- New: Automation tools: GNAT (GNOC)

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

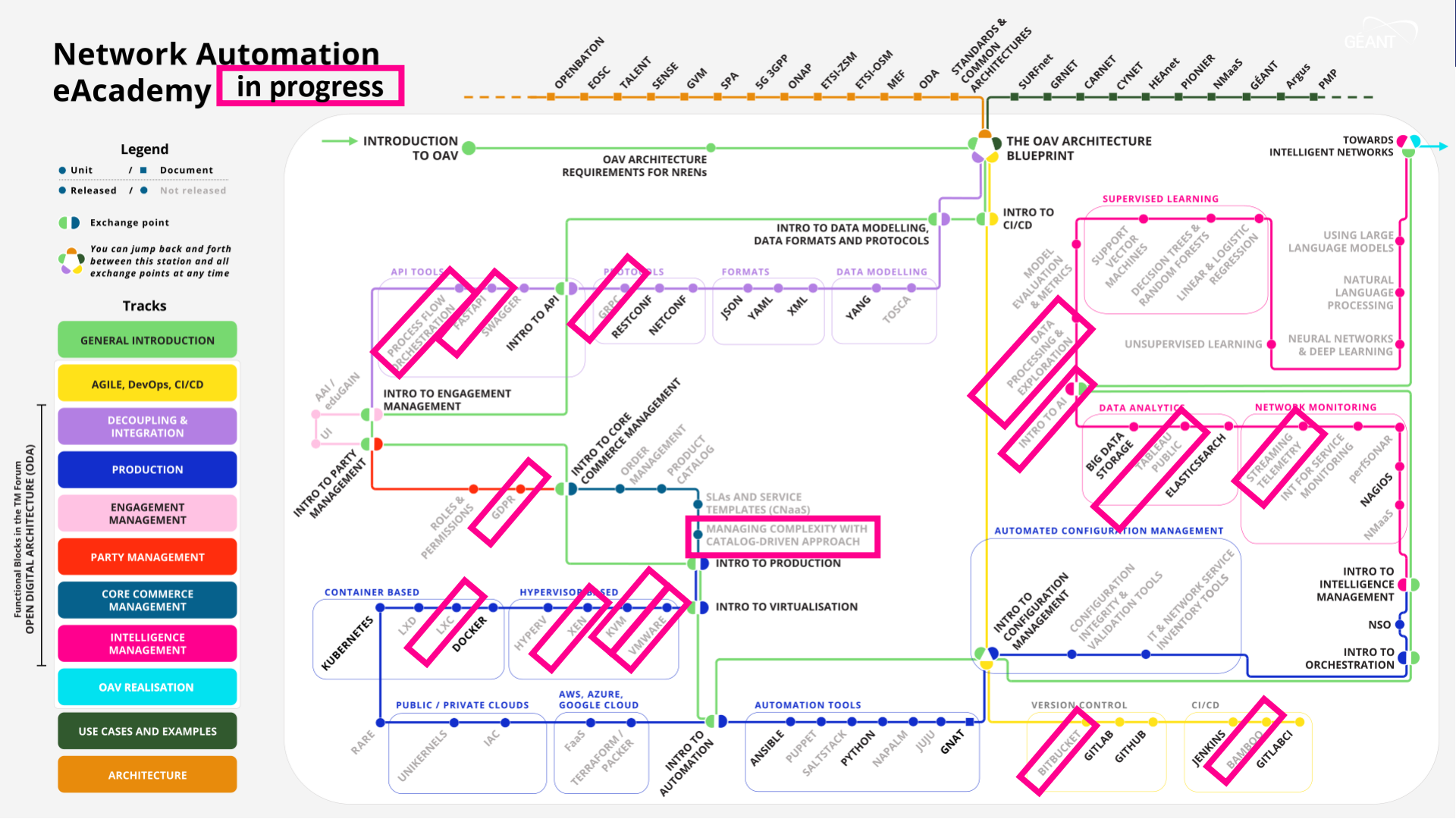
Practical Examples

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.

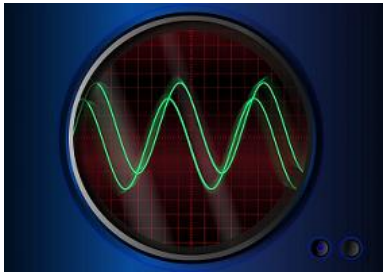
Network Automation eAcademy

in progress

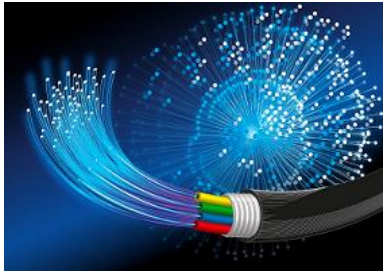


Currently Working also on Training for:

Training



Optical Time and Frequency Networks (OTFN)



Quantum Technologies

Currently working on – Quantum in progress

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

Thank You!

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

www.geant.org

Co-funded by
the European Union