



Network eAcademy

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Trobada de l'Anella Científica
20 Juny 2024, Girona

Public (PU)

Els tres barrets de la Maria Isabel



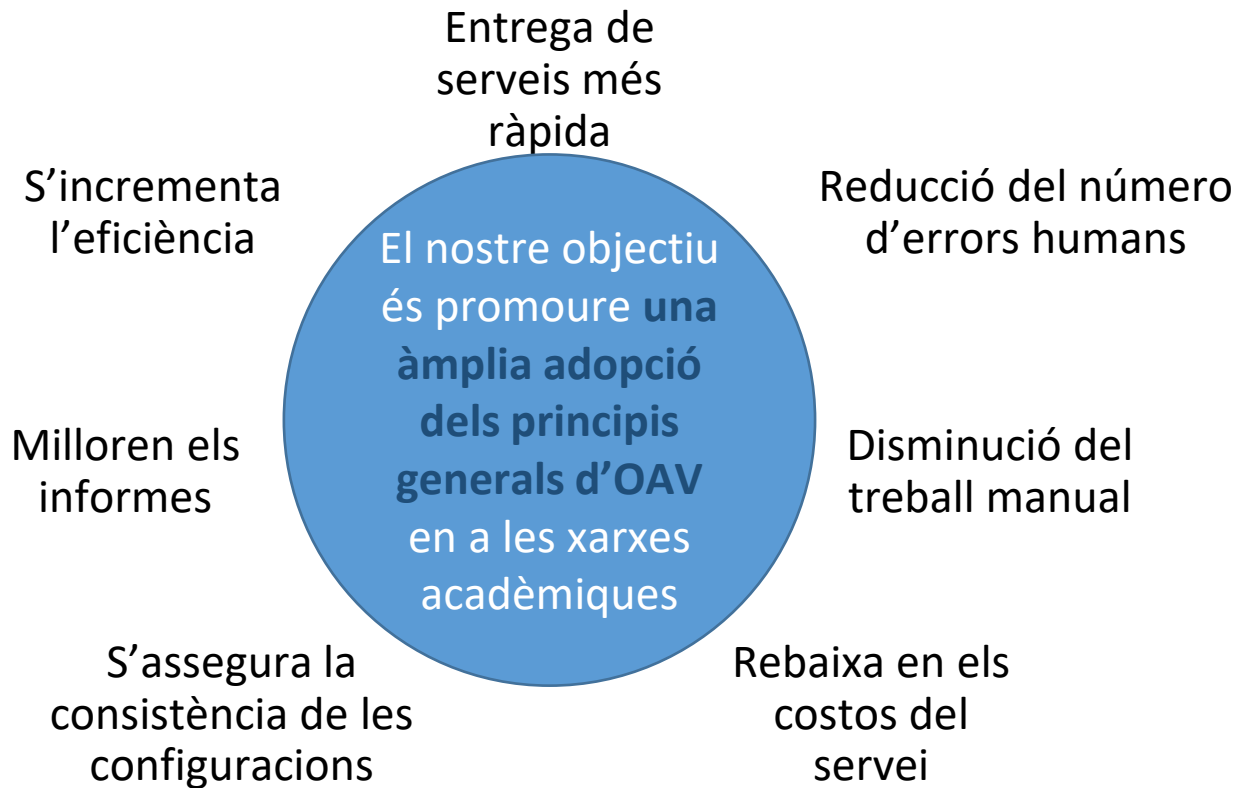
Introducció – El projecte GÉANT

GÉANT és la col·laboració de les NREN (xarxes nacionals de recerca i educació) europees per oferir un ecosistema d'informació en infraestructura i serveis per avançar en recerca, educació i innovació a escala global:

- 50 milions d'usuaris
- 500 col·laboradors de 37 membres
- 9 projectes fins ara
- Generació actual: GN5-1



OAV: Orquestració, Automatització i Virtualització



Aproximació col·laborativa a OAV en la comunitat GÉANT



Necessitat de col·laboració i intercanvi de coneixements i experiència



Escletxa de coneixement



Parlem llengües diferents



Es necessita un “patró” d'arquitectura acceptat en general



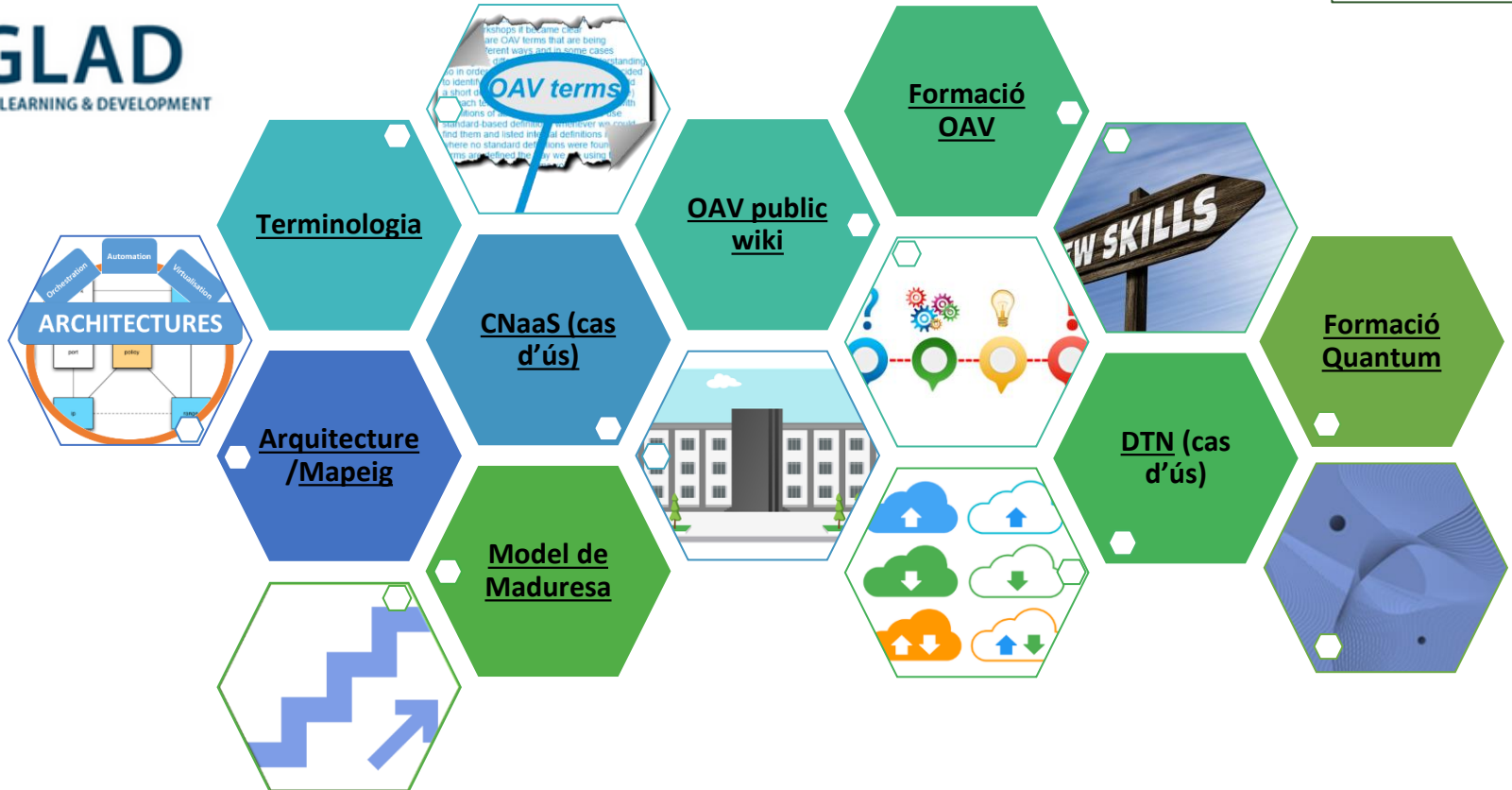
Les xarxes acadèmiques comparteixen informació i aprenen de les altres

Network eAcademy

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Network
eAcademy



Terminologia i Glossari de termes OAV

- Necessitat d'un acord sobre terminologia.
- La idea és tenir un terreny comú per entendre's.
- Versió 2.0 publicada amb termes addicionals sobre **IA i Model de Maduresa**
- Acceptat pel Grup de Treball d'Automatització del GNA-G

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	<p><i>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.</i></p> <ul style="list-style-type: none"> • https://www.gartner.com/en/information-technology/glossary/aiops-artificial-intelligence-operations
AI-powered Virtual Agent (AIVA)	<p><i>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.</i></p> <ul style="list-style-type: none"> • 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)	<p><i>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.</i></p>

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



Model de Maduresa en OAV

Model de Maduresa

Mesurar	Mesurar les capacitats OAV de manera útil
Identificar	Identificar les febleses, amenaces, fortaleses i oportunitats
Prioritzar	Ajudar a prioritzar els següents passos per avançar i millorar
Marcar la ruta	Identificar esclatxes entre l'estat actual i futur i veure com arribar-hi

Enquesta (31 preguntes)*: <https://www.surveymonkey.com/r/SPYDQVB>

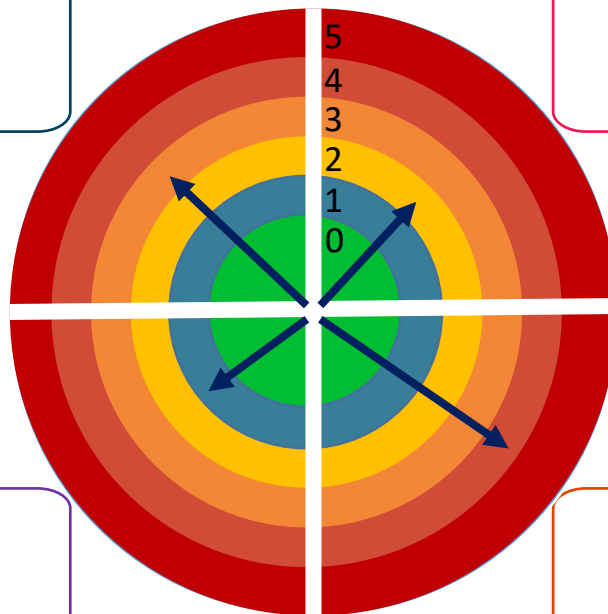
Informació sobre dimensions i etapes: <https://wiki.geant.org/display/NETDEV/OAV+Maturity+Model>

Model de Maduresa en OAV - Dimensions

Model de
Maduresa

Arquitectura i
Tecnologia

Processos i
Serveis



Visió i
Estratègia

Persones i
Organització

Model de Maduresa en OAV – Etapes/Nivells

Model de
Maduresa

Nivell 0

Asseguts

Res



Created by Valeria Lopez

Nivell 1

Gatejant

Ad Hoc



Nivell 2

Caminant

Basada en
casos d'ús i
projectes /
Reactiva



Created by Valeria Lopez

Nivell 3

Corrent

Integrada



Nivell 4

Volant

Proactiva



Created by Valeria Lopez

Nivell 5

Energitzant










Self-*



Wiki

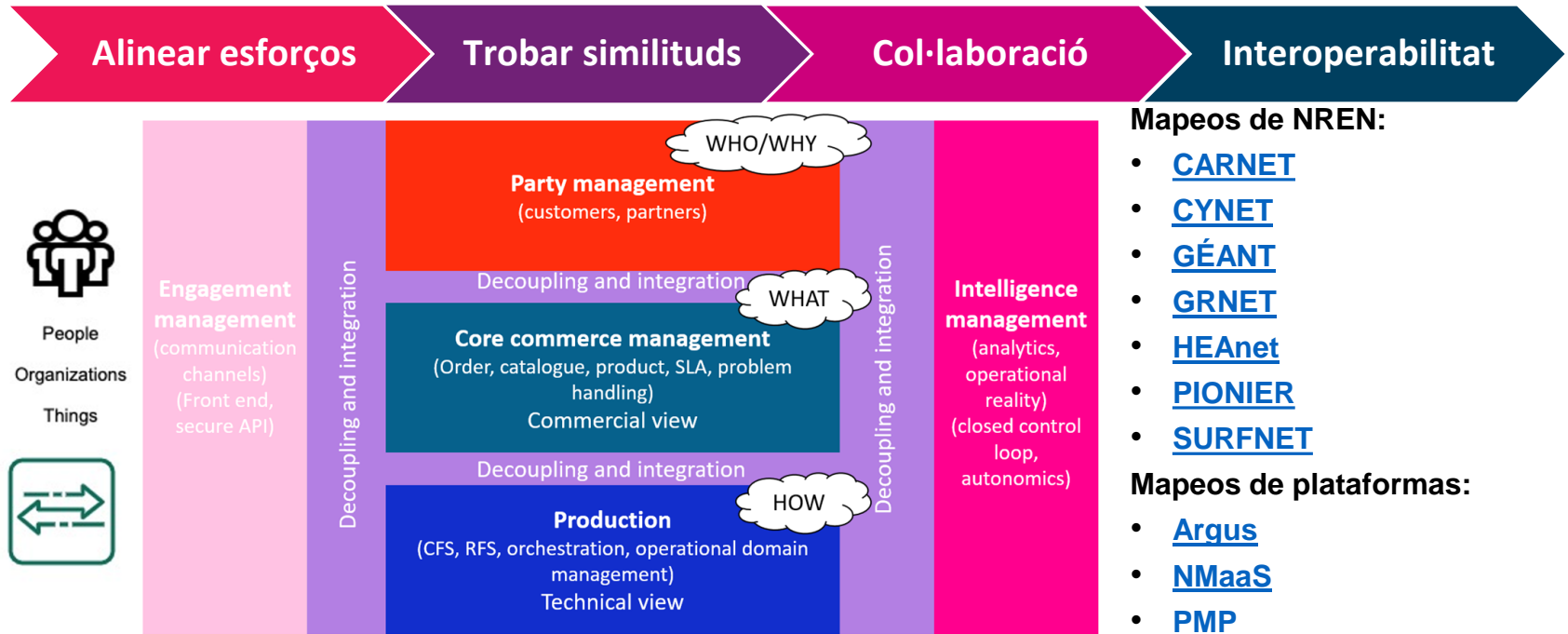
Wiki

- [Community Portal](#)
- Seccions per OAV:
 - [Architecture](#)
 - [Training](#)
 - [Maturity Model](#)
 - [Terminology](#)
 - [Literature](#)
 - [Dissemination: Deliverables, Infoshares, Presentacions, 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		<ul style="list-style-type: none"> • https://www.aarnet.edu.au/ • Hendrik Buning, David Jencho. Orchestration, Automation and Virtualisation, BOF, TNC19, Tallinn, Estonia, June 20, 2019 (pdf)
ARNES		<ul style="list-style-type: none"> • 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/46892sq4bbo9683j8eybg05du7jntz
CARNET		<ul style="list-style-type: none"> • https://www.carnet.hr/ • Damir Regvar, Lidija Jakovčević, Siviđe Mišić. 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/9j5tdtbv2dshuffed137x7m9806mm16 • See the lightning talk during the Network Management and Monitoring Workshop.
CSUC		<ul style="list-style-type: none"> • 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		<ul style="list-style-type: none"> • http://www.cynet.ac.cy/ • sibila@acac: 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		<ul style="list-style-type: none"> • http://es.net/ • John MacKuley. Service orchestration in ESnet6, BOF, TNC19, Tallinn, Estonia, June 20, 2019 (pdf)
FUNET		<ul style="list-style-type: none"> • https://www.csc.fi/funet-kalkki-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=1571047052736&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.
GEANT		<ul style="list-style-type: none"> • https://www.geant.org/ • Bram Peeters. Orchestration, Automation and Virtualisation (OAV) in GEANT, 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-NOG meeting presentation

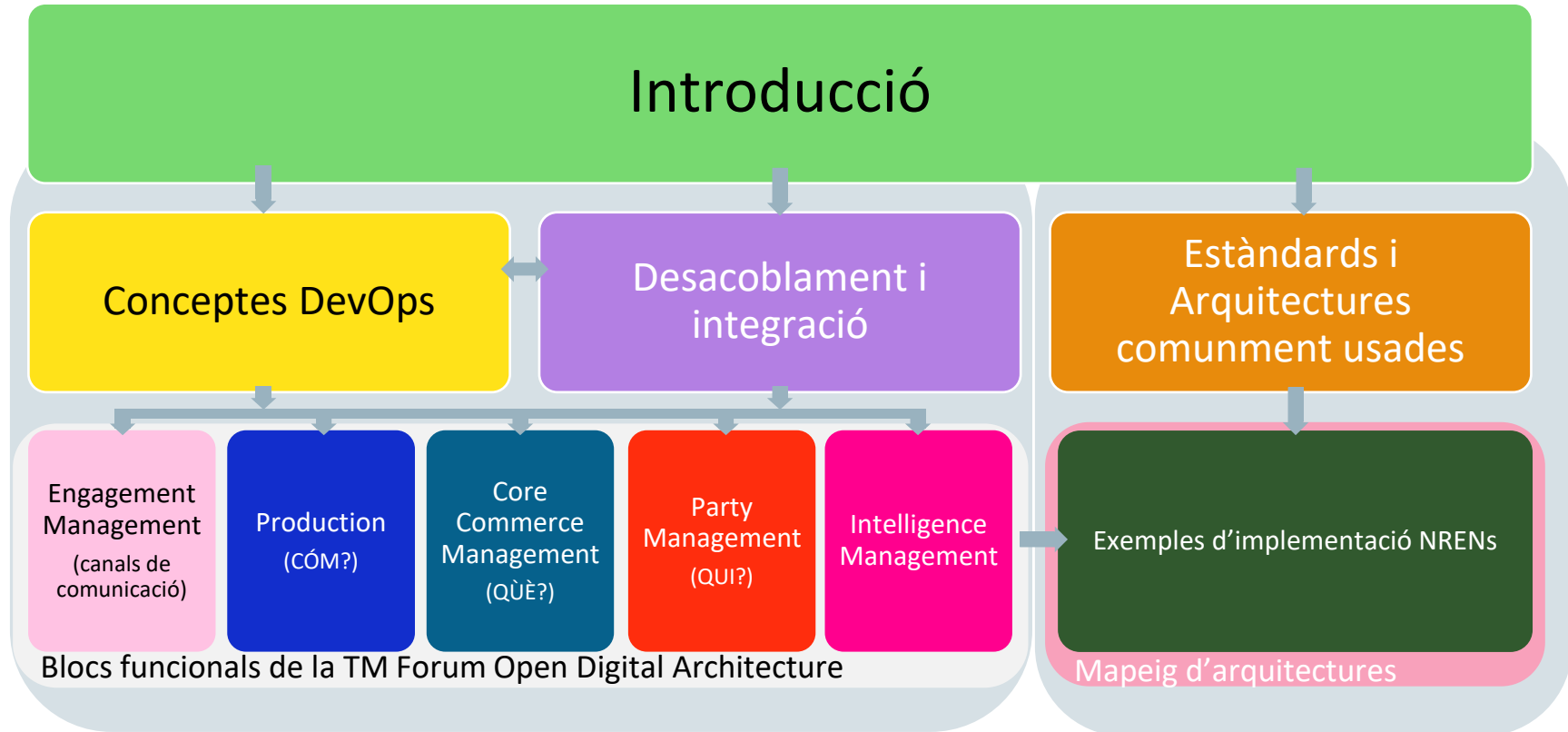
Arquitectura y 'mapejos'

- Mapeig de les arquitectures de NREN i serveis a un patró comú, la TM Forum Open Digital Architecture (arquitectura funcional).



Mapa de coneixement pel pla de formació

Formació



Network Automation eAcademy



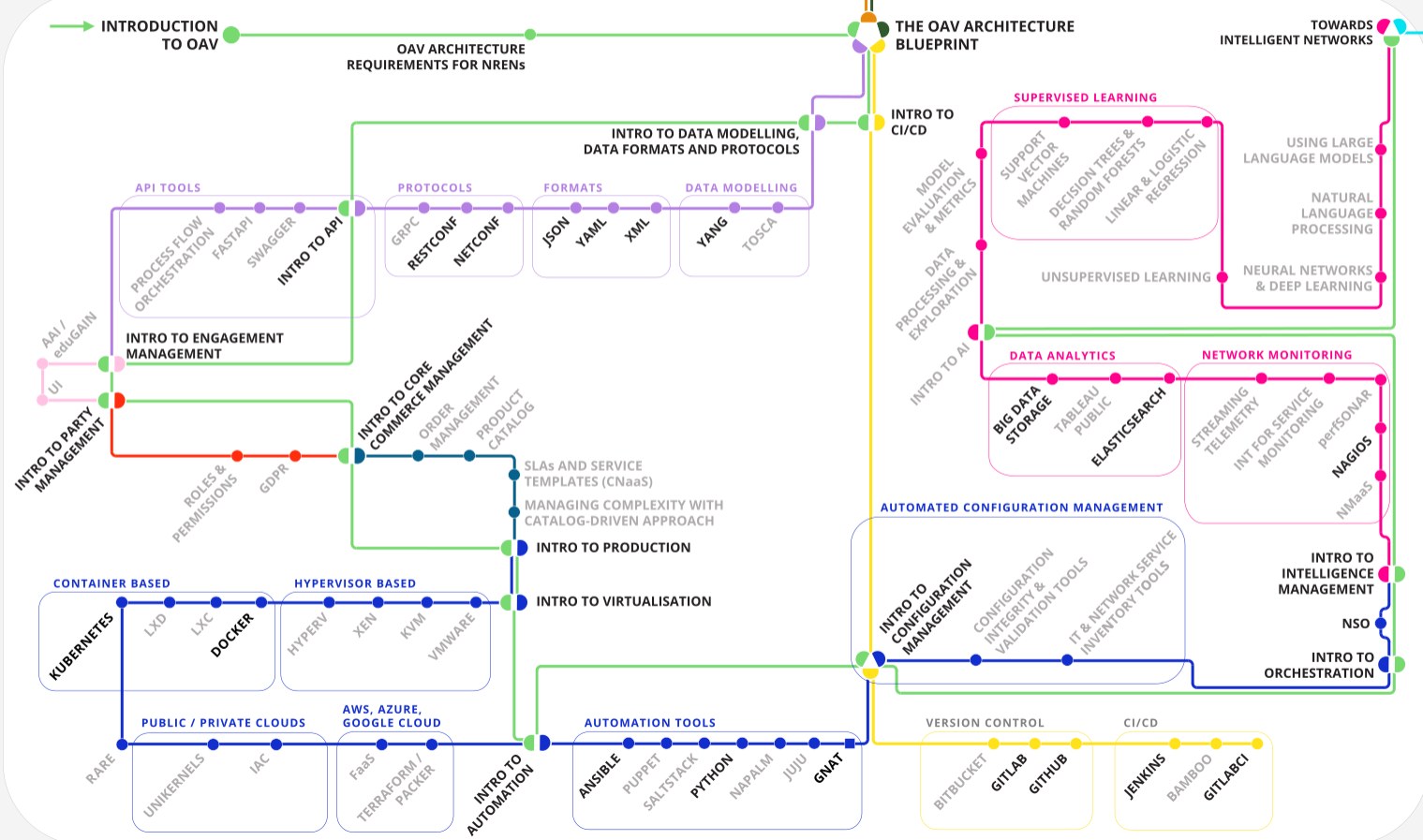
Legend

- Unit / ■ Document
- Released / ● Not released
- Exchange point

You can jump back and forth between this station and all exchange points at any time

Tracks

- GENERAL INTRODUCTION
- AGILE, DevOps, CI/CD
- DECOUPLING & INTEGRATION
- PRODUCTION
- ENGAGEMENT MANAGEMENT
- PARTY MANAGEMENT
- CORE COMMERCE MANAGEMENT
- INTELLIGENCE MANAGEMENT
- OAV REALISATION
- USE CASES AND EXAMPLES
- ARCHITECTURE



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

Línia introductòria

Formació

Network Automation Academy

INTRODUCTION TO OAV

General

30'

Network Automation Academy

OAV ARCHITECTURE REQUIREMENTS FOR NRENs

General

10'

Network Automation Academy

THE OAV ARCHITECTURE BLUEPRINT

General

Open Digital Architecture

30'

Network Automation Academy

INTRODUCTION TO CI/CD

General

Apps, DevOps, CI/CD

15'

Network Automation Academy

INTRODUCTION TO DATA MODELLING, DATA FORMATS AND PROTOCOLS

General

Open Digital Architecture

Decoupling & Integration

30'

Network Automation Academy

APIs: INTRODUCTION TO API

General

Open Digital Architecture

Decoupling & Integration

45'

Network Automation Academy

INTRODUCTION TO ENGAGEMENT MANAGEMENT

General

Open Digital Architecture

Engagement Management

15'

Network Automation Academy

INTRODUCTION TO PARTY MANAGEMENT

General

Open Digital Architecture

Party Management

15'

Network Automation Academy

INTRODUCTION TO CORE COMMERCE MANAGEMENT

General

Open Digital Architecture

Core Commerce Management

15'

Network Automation Academy

INTRODUCTION TO PRODUCTION

General

Open Digital Architecture

Production

30'

Network Automation Academy

INTRODUCTION TO VIRTUALISATION

General

Open Digital Architecture

Production Virtualisation

30'

Network Automation Academy

INTRODUCTION TO AUTOMATION

General

Open Digital Architecture

Production Automation

30'

Network Automation Academy

AUTOMATED CONFIGURATION MANAGEMENT: INTRODUCTION TO CONFIGURATION MANAGEMENT

General

Open Digital Architecture

Production Automation

30'

Network Automation Academy

INTRODUCTION TO ORCHESTRATION

General

Open Digital Architecture

Production Orchestration

30'

Network Automation Academy

INTRODUCTION TO INTELLIGENCE MANAGEMENT

General

Open Digital Architecture

Intelligence Management

15'

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

+Training+Portal

Desacoblament i Integració (Data Models, Formats, Protocols, APIs)

Formació

Network Automation Academy

INTRODUCTION TO DATA MODELLING, DATA FORMATS AND PROTOCOLS

General
Open Digital Architecture
Decoupling & Integration

30'

Network Automation Academy

DATA MODELLING: YANG

Open Digital Architecture
Decoupling & Integration

10'

Network Automation Academy

DATA FORMATS: XML

Open Digital Architecture
Decoupling & Integration

60'

Network Automation Academy

DATA FORMATS: YAML

Open Digital Architecture
Decoupling & Integration

30'

Network Automation Academy

DATA FORMATS: JSON

Open Digital Architecture
Decoupling & Integration

45'

Network Automation Academy

PROTOCOLS: NETCONF

Open Digital Architecture
Decoupling & Integration

4h (including installation)

Network Automation Academy

PROTOCOLS: RESTCONF

Open Digital Architecture
Decoupling & Integration

2h

Network Automation Academy

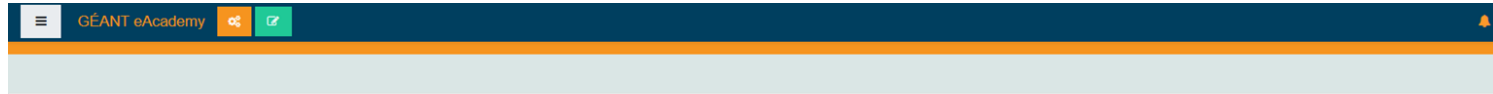
APIs: INTRODUCTION TO API

General
Open Digital Architecture
Decoupling & Integration

45'

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

Ansible



Ansible

Home > My courses > Technical skills > Network > Network Automation eAcademy > Ansible

OVERVIEW | I - Settings, Inventory, Module Basics | II - Playbooks, Variables and Modules | III - How people use Ansible, Loops, Jinja2 | IV - Playbook Validation, Vault, Roles, Sharing content | Test environments and Useful Links | Feedback and Completion Certificate

Welcome to the Course: Ansible



COURSE DATE: On Demand	DURATION: 60 minutes	COMMITMENT: 60 minutes + lab time
REQUIREMENT: YAML Learning Module	COURSE TYPE: Self-paced	CREDENTIAL: Certificate

Learning path:	OAV Training Portal
Prerequisite:	Formats: YAML
Preceded by:	Introduction to Automation
Followed by:	Puppet (not yet published)
Next available:	Configuration Management

Course summary

Ansible is an automation framework which allows users to manage services, the servers on which they run and the network devices which interconnect them. This course has several sections which should be taken in order,

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

Requisites per Ansible: YAML, Requisites per YAML?



Formats: YAML

Home > My courses > Technical skills > Network > Network Automation eAcademy > Formats: YAML

OVERVIEW Main Goals Formats: YAML Useful Links Quiz Feedback & Certicate

Welcome to the Course: Formats: YAML



COURSE DATE:

From September 2021



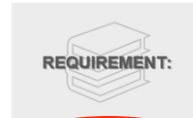
DURATION:

20 min



COMMITMENT:

30 min



REQUIREMENT:

Introduction to Data Models, Data
Formats, and Protocols (recommended)



COURSE TYPE:

Selfpaced



CREDENTIAL:

Certificate of completion

Learning path:	OAV Training Portal
Preceded by:	Formats: XML
Followed by:	Formats: JSON

Course summary

YAML is a human-friendly data serialisation standard broadly used in Orchestration, Automation and Virtualisation (OAV). This course offers a quick overview of the YAML syntax and some examples from the real world in a single video, with useful tips and references and a quiz.

In more detail, the learning unit discusses the following topics:

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

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

☰
GÉANT eAcademy

Data modelling, data formats and protocols - Introduction

Home
My courses
Technical skills
Network
Network Automation eAcademy
Introduction to data modeling, data formats and protocols

OVERVIEW
Main Goals
Course Materials
Definitions
Data Modelling
Data Formats
Protocols
Links
Quiz
Feedback Form & Certificate of Completion

Welcome to the Introduction to Data Modelling, Data Formats and Protocols learning unit

Network Automation eAcademy

INTRODUCTION TO DATA MODELLING, DATA FORMATS AND PROTOCOLS

General

Open Digital Architecture

Designing & Integration

COURSE DATE:

From January 2021

DURATION:

20 minutes

COMMITMENT:

30 minutes

REQUIREMENT:

None

COURSE TYPE:

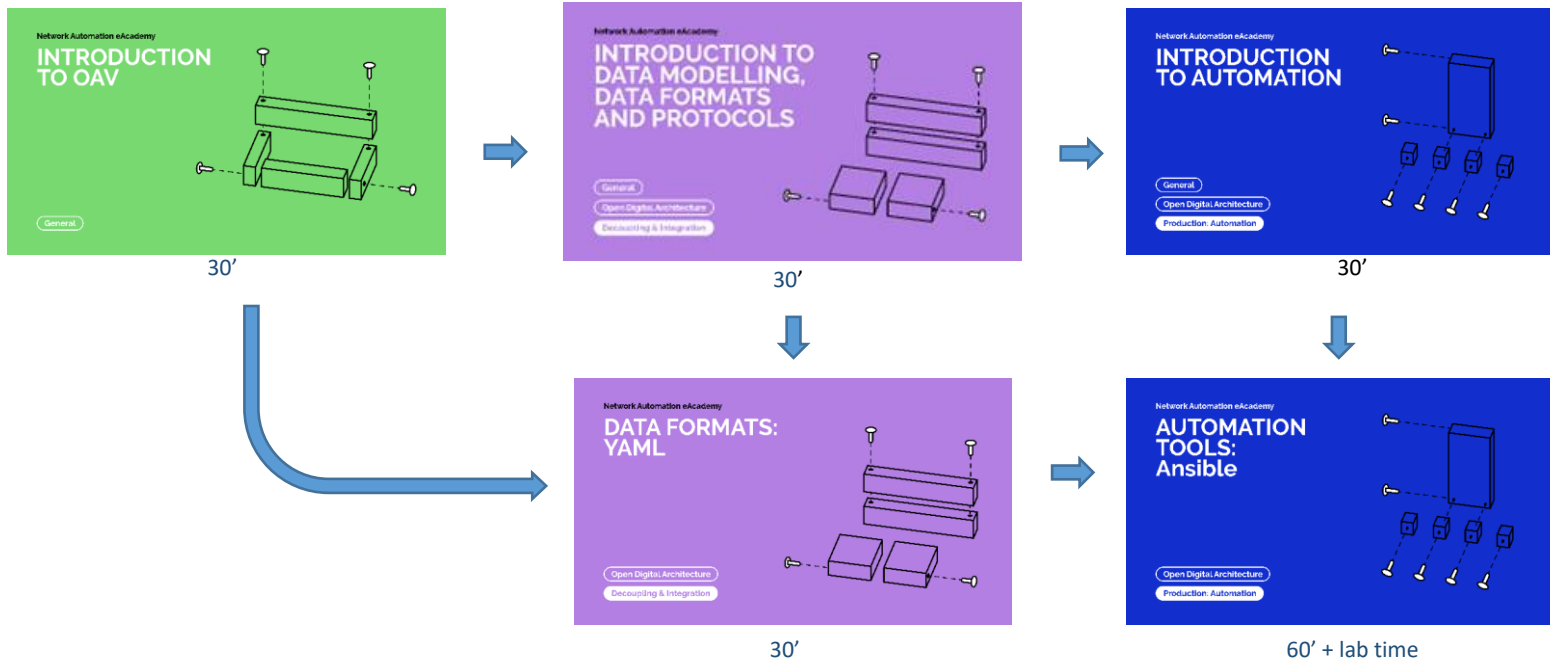
Self-paced

CREDENTIAL:

Certificate of Completion

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

Ansible



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

Ansible: vídeos amb subtítols

GEANT eAcademy

Ansible

Home > My courses > Technical skills > Network > Network Automation eAcademy > Ansible > II - Playbooks, Variables and Modules

OVERVIEW I - Settings, Inventory, Module Basics II - Playbooks, Variables and Modules III - How people use Ansible, Loops, Jinja2 IV - Playbook Validation, Vault, Roles, Sharing content Test environments and Useful Links Fee

Please watch the video below to continue your Ansible learning journey.

At the end of this section you will be able to

- Run playbooks and parse their outputs
- Use ssh troubleshooting to identify problems which Ansible may hide from you
- Understand Ansible's use of variables and how to reference their value
- Understand Ansible's host_vars/group_vars directory structure
- Understand what modules do and how to use them in playbooks

```

---
- name: Install mod_rewrite on all webservers
  hosts: webservers
  become: true
  tasks:
    - name: Install Apache
      apt: pkg=apache2 state=latest

    - name: enable mod_rewrite
      apache2_module: name=rewrite state=present
      notify:
        - restart_apache2

  handlers:
    - name: restart_apache2
      service: name=apache2 state=restarted
  
```

20 section2/playbooks/install_Apache_with_handlers.yaml www.geant.org

Ansible section II - slides and speaker notes PDF document

Ansible: presentació amb notes (guió)

GEANT eAcademy

Ansible

Home > My courses > Technical skills > Network > H...

OVERVIEW I - Settings, Inventory, Module Basics II - Playbooks

Please watch the video below to continue your Ansible learning journey.

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- Understand Ansible's use of variables and how to reference their
- Understand Ansible's host_vars/group_vars directory structure
- Understand what modules do and how to use them in playbooks

Playbooks

```

---
# Oh look, a comment...
# ...spread out over multiple lines

- name: Set up Apache           # Or nginx, or Mongoose
  hosts: webservers
  tasks:
    - name: install Apache
    - name: generate Apache config file
    - name: download Web content to relevant directory
    - name: restart Apache
    - name: eat cake
  
```

5

www.geant.org



Most ansible users gather their Ansible work in YAML files called **Playbooks** – which start with three dashes. Playbook **comments** start with hashes, and are one per line. Playbooks contain a list of plays, or groups of tasks. In a playbook, look for the dashes in column one to see the list of plays. In the example shown here, there is one play (**Set up Apache**).

Playbooks can also contain the hosts or groups which the tasks should influence; these

Cursos actualment a la Network eAcademy – Automatització

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')

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socials)



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** (GNOQ)

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

Exemples pràctics

- Ansible:
 - Repositori Git amb els exemples de la unitat
 - Mini-Lab: entorn de test Vagrant amb un servidor Unix i un JunOS.
- NETCONF:
 - Guia d'instal·lació amb entorn virtual en GNS3.
 - Cóm afegir una ruta estàtica a un encaminador, pas a pas.
- NSO:
 - Instal·lació de la versió de prova (*free trial*).
 - Configuració d'un servidor Radius sobre múltiples dispositius.
 - Desplegar una ACL en múltiples dispositius i/o interfícies d'un dispositiu.

Network Automation eAcademy

en curs



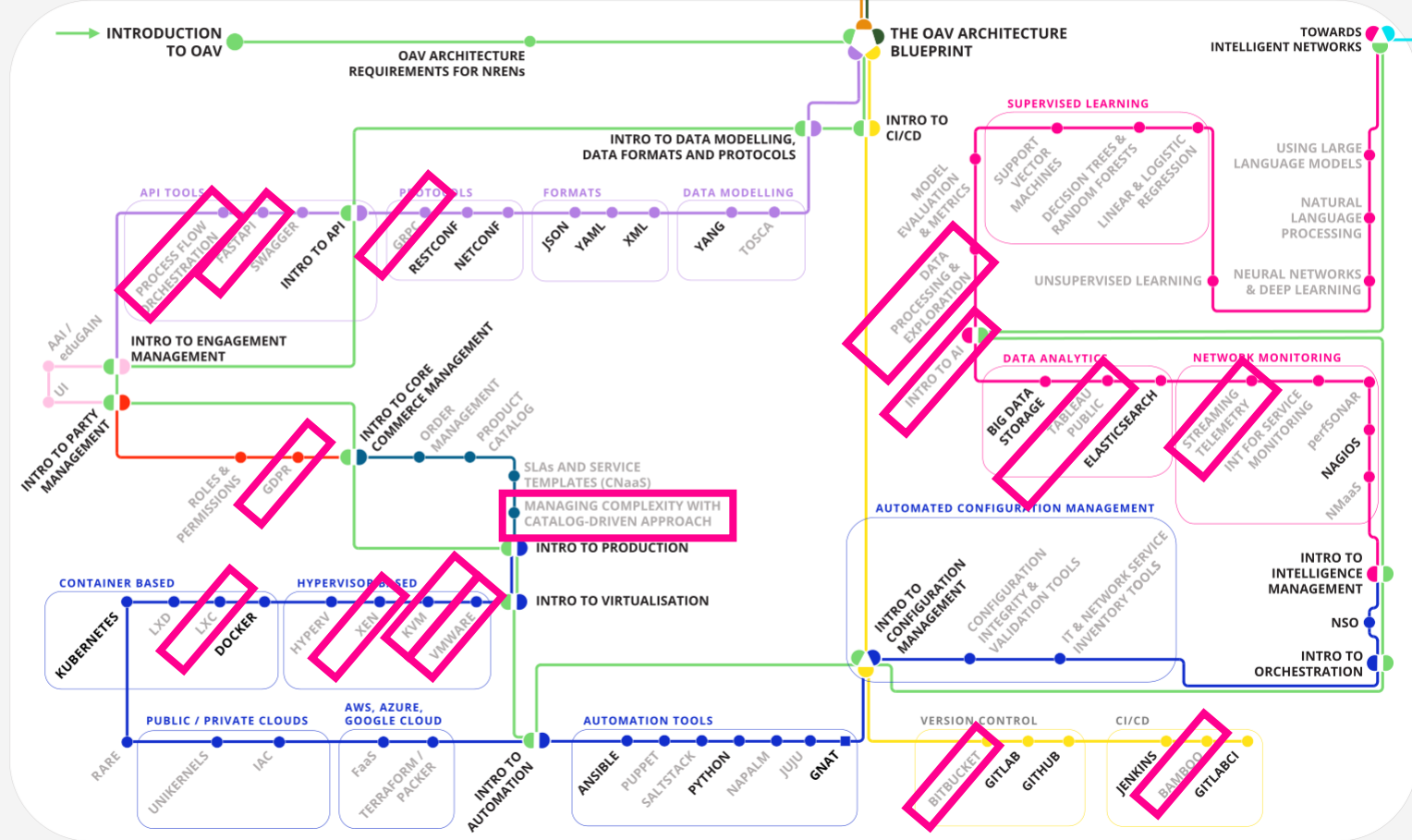
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- CORE COMMERCE MANAGEMENT
- INTELLIGENCE MANAGEMENT
- OAV REALISATION
- USE CASES AND EXAMPLES
- ARCHITECTURE

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

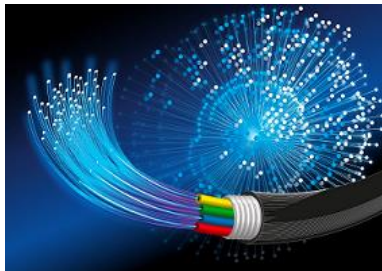


També treballant en formació per a

Formació



[Optical Time and Frequency Networks \(OTFN\)](#)



[Quantum Technologies](#)

Actualment treballant en Quantum


en curs

Formació




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



Gràcies!

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www.geant.org



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