

# Network Automation e-Academy

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*GN4-3, WP6-T2*

ESNOG27

Matadero Medialab

16 Noviembre 2021

[www.geant.org](http://www.geant.org)

# 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** available to them



- A part of the European Union's Horizon 2020 research and innovation programme
  - GÉANT 2020 Framework Partnership Agreement (FPA)



- 40 partners, 500 contributors

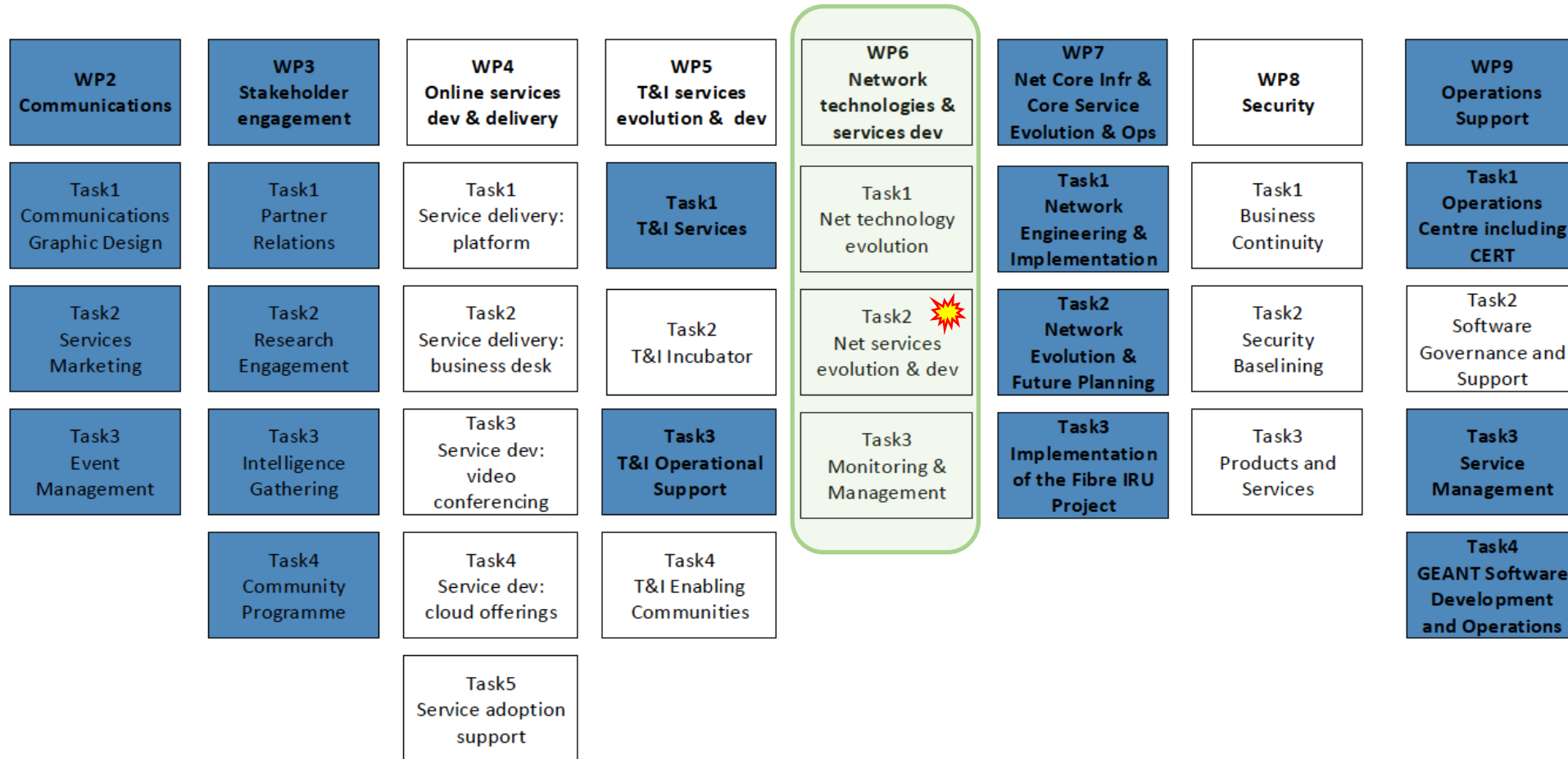


- 50 M users



- GN4-3 started 1 Jan 2019 as a 4 year project

# GÉANT Project Structure



## Investigation of OAV in the GÉANT community

- Most of the work known so far is single-domain and domain-specific.
- It was first necessary to understand the current situation for OAV adoption in the community.
- A period of consensus building at the start of GN4-3 was required.
- It started with an **NREN OAV survey** to:
  - Learn about strategy/actions of each NREN related to OAV.
  - Explore if there are common OAV use cases, ideas, and issues.
  - Recognise possible areas of collaboration among NRENs and GÉANT.
  - Determine possible future work in WP6 (or other WPs) that could be of benefit to as many partners as possible for identified use case(s).

## OAV Survey (Orchestration, Automation, Virtualisation) - Sections

Existing Network and Services Support Platforms

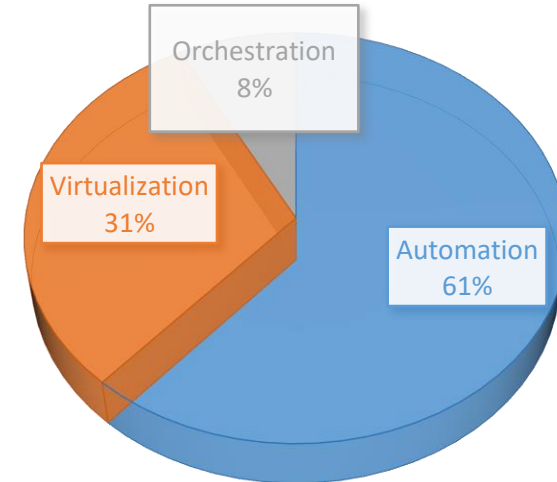
Current OAV Use Cases and Services

OAV Challenges and Priorities

Future OAV Use Cases and Services

How can the GÉANT Community / the GÉANT Project help?

### WHAT WORK IS IMPLEMENTED FIRST



[\\*https://www.geant.org/Projects/GEANT Project GN4-3/GN43 deliverables/D6-2 Automation-and-Orchestration-of-Services-in-the-GEANT-Community.pdf](https://www.geant.org/Projects/GEANT%20Project%20GN4-3/GN43%20deliverables/D6-2%20Automation-and-Orchestration-of-Services-in-the-GEANT-Community.pdf)



## Common pain points

- **Manpower** - number, skill, expertise
- **Brownfield** - existing systems, hard to make changes in production, CI CD
- **Priorities** - existing systems; continuous operations vs. new development
- **Time** - split between the operations and R&D
- **Cost** - additional people, additional software, software replacement
- **Limitations of the proprietary solutions**

NREN consultation clearly showed:

- That there is a diversity of perspectives
- NRENs are at varying stages of OAV concerning implementation / experience

## Survey Results: Skills needed for OAV and whether people in NRENs have them



- Software development skills
- Software development and networking skills (unicorns?)
- Additional personnel

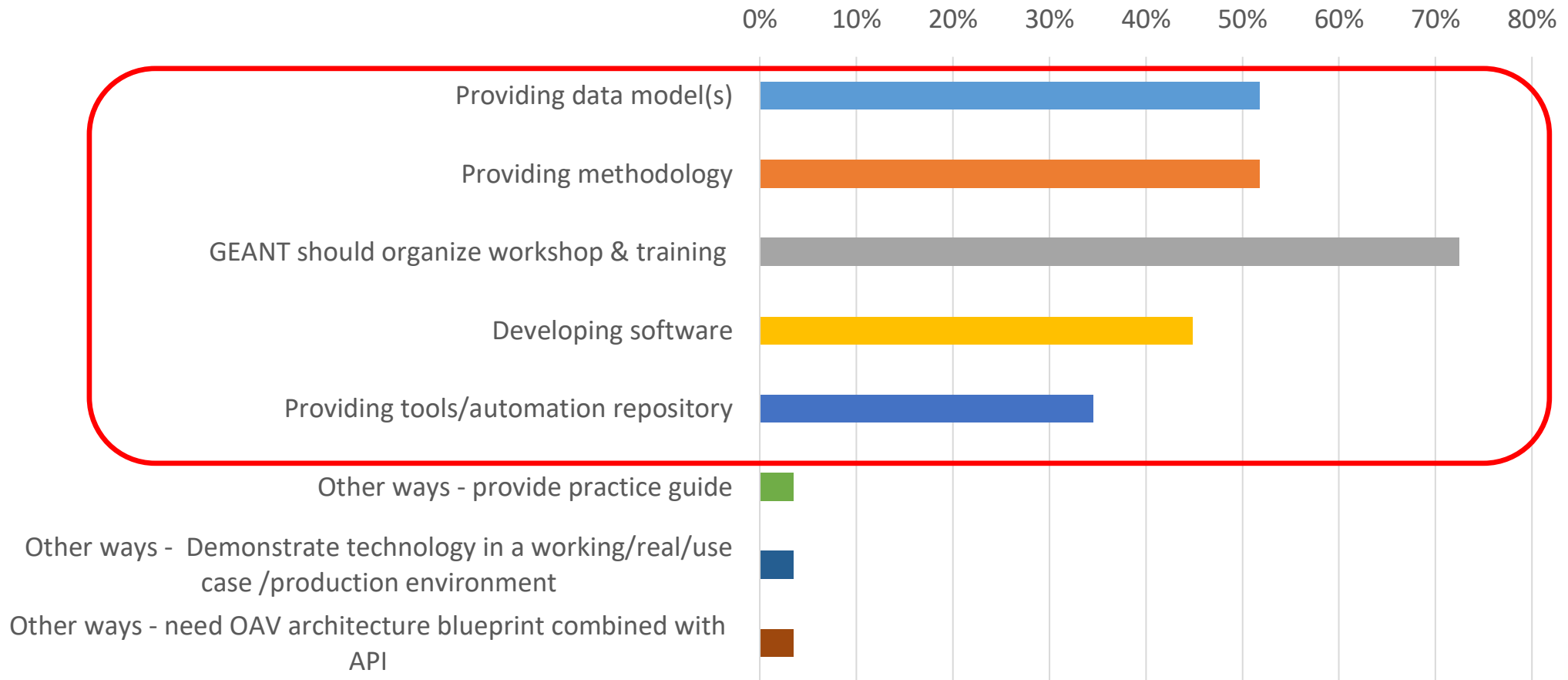
# Survey Results: Concerns by NOC teams around increased automation

Concerns more widely reported are related to:

- Automating failures due to mistakes / inadequate software / reduced troubleshooting capabilities
- Lack of ability for tailor-made services / lack of flexibility
- Lack of appropriate employee skills / need for training / lots of required effort to setup



# GÉANT Potential Contribution



# 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

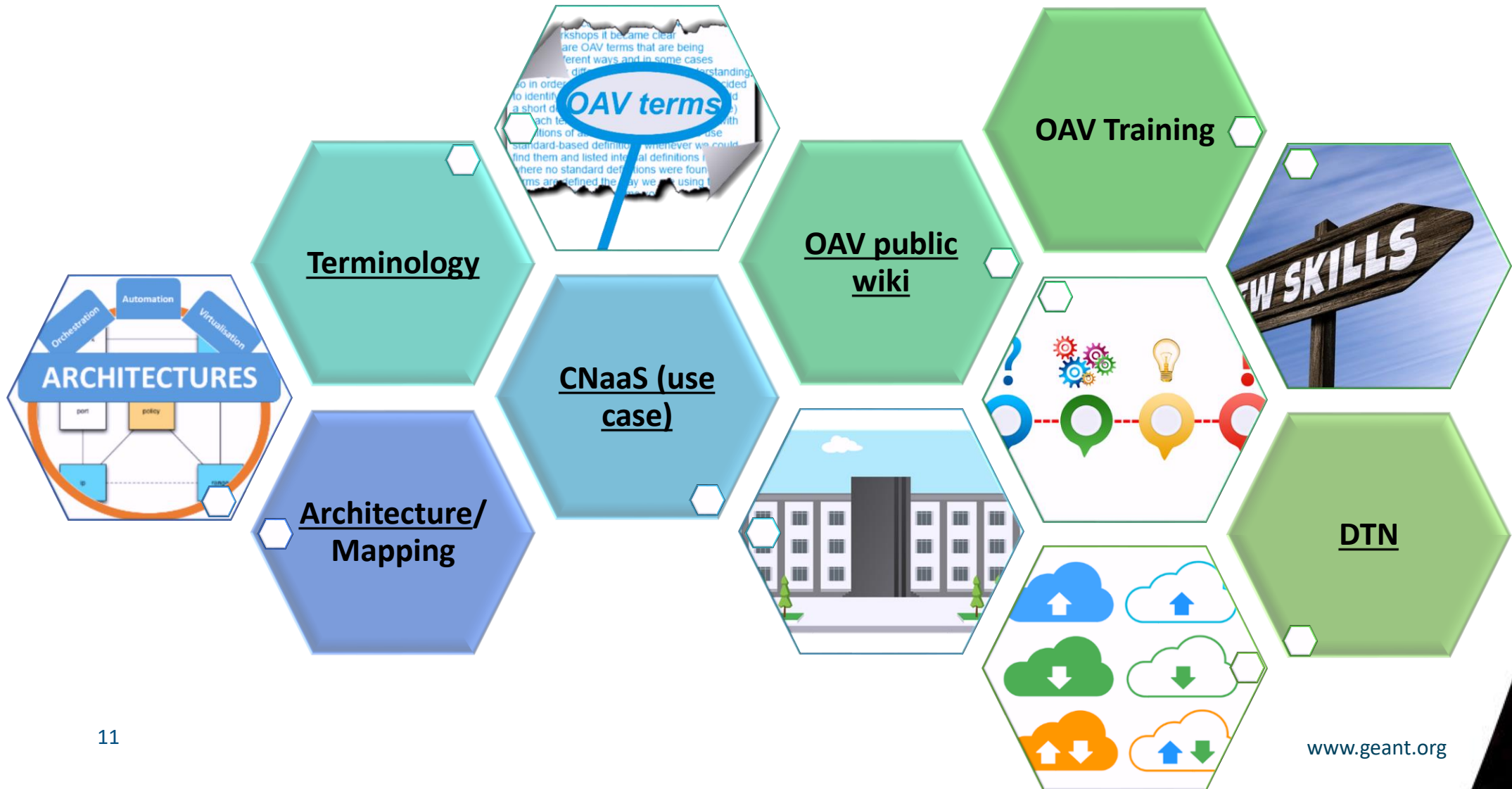


A generally accepted architecture blueprint needed



NRENs are willing to share experiences and learn from others

# Consensus Building – OAV focus groups



# Terminology

- Need for an agreement on common terminology.
- The idea is to have a common ground of understanding.



# Terminology – Terms and Glossary

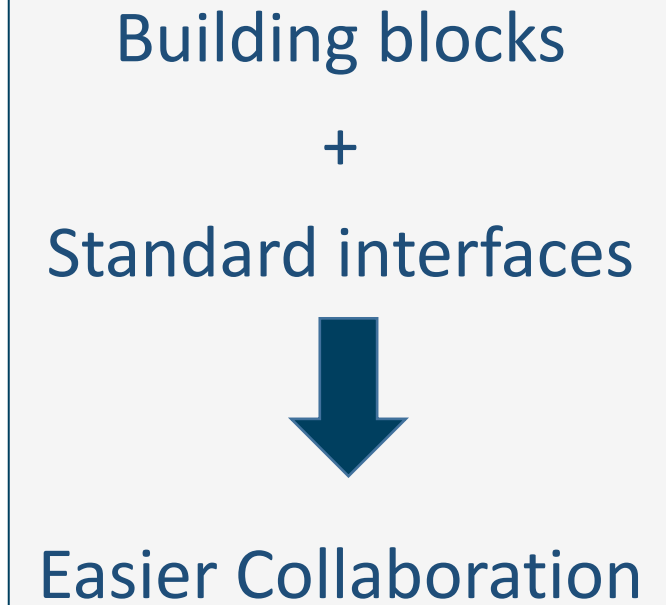
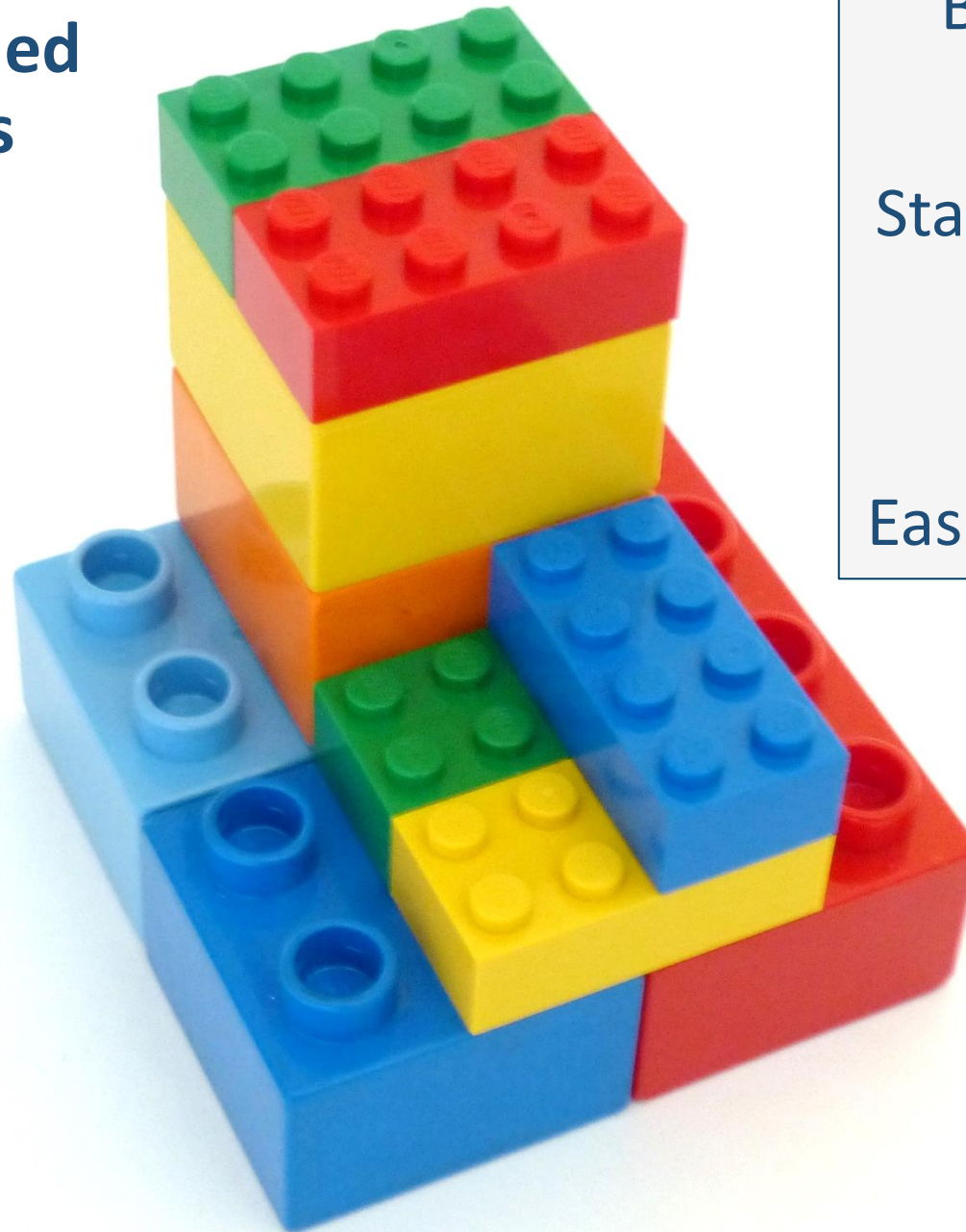
OAV Common Terms  
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z  
Glossary

OAV Terms	Definition and reference
Architecture component	An architecture component is a non-trivial, nearly independent, and replaceable part of a system that fulfills a clear function in the context of a well-defined architecture. • TM Forum Reference, TMF071 ODA Terminology, TMF071, Release 19.0.1, October 2019
Architecture principles	Architecture principles define the underlying general rules and guidelines for the use and deployment of all IT resources and assets across the organisation. They reflect a level of consensus among the various elements of the enterprise, and form the basis for making future IT decisions. • based on <a href="https://pubs.opengroup.org/architecture/iso9845-d02/arch/chap30.html">https://pubs.opengroup.org/architecture/iso9845-d02/arch/chap30.html</a>
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. • based on <a href="https://techterms.com/definition/api">https://techterms.com/definition/api</a> and <a href="https://search.acloudplatform.techtarget.com/definition/application-program-interface-API">https://search.acloudplatform.techtarget.com/definition/application-program-interface-API</a>
Automated service provisioning	Automated service provisioning is the ability to deploy an information technology or telecommunications service by using pre-defined procedures that are carried out electronically without requiring human intervention. • based on <a href="https://techterms.com/definition/api">https://techterms.com/definition/api</a> and <a href="https://search.acloudplatform.techtarget.com/definition/application-program-interface-API">https://search.acloudplatform.techtarget.com/definition/application-program-interface-API</a>
Automation	Processing tasks in a repeatable manner to yield the same result every time without human intervention. • multiple sources including US government documents, e.g. Financial Services and General Government Appropriations for 2016 p.201 ( <a href="https://books.google.de/books?id=H4D9m33aUcC&amp;printsec=frontcover&amp;hl=de&amp;source=gbs_summary_f&amp;cad=rhl#onepage=201&amp;f=false">https://books.google.de/books?id=H4D9m33aUcC&amp;printsec=frontcover&amp;hl=de&amp;source=gbs_summary_f&amp;cad=rhl#onepage=201&amp;f=false</a> )
Blockchain	Blockchain is an expanding list of cryptographically signed, irrevocable transactional records shared by all participants in a network. • internal definition
Cgroups (control groups)	Groups are Linux kernel mechanisms to restrict and measure resource allocations to each process group. Using groups, you can allocate resources such as CPU time, network, and memory. • reduced from TM Forum Reference, TMF071 ODA Terminology, TMF071, Release 19.0.1, October 2019 • <a href="https://subscription.pactpub.com/book/application_development/9781765983057/1/ch01we1sect15/namespaces-and-cgroups">https://subscription.pactpub.com/book/application_development/9781765983057/1/ch01we1sect15/namespaces-and-cgroups</a>
Cloud native application	Cloud Native Application (CNA) refers to a type of computer software that natively utilises services and infrastructure provided by cloud computing providers. • reduced from TM Forum Reference, TMF071 ODA Terminology, TMF071, Release 19.0.1, October 2019
Component	A component is a functionally independent part of any system. It performs some function and may require some input or produce some output.

GLOSSARY	
Abbreviation/ Acronym	Description/Definition
ABE	Aggregate Business Entity
AI	Artificial Intelligence
AMC	Autonomic Management and Control
AWS	Amazon Web Services
BPMN	Business Process Model and Notation
BSS	Business Support System
CBP	Ciena Blue Planet
CDE	Component Description
CDN	Content Delivery Network
CNA	Cloud Native Application
CNI	Container Network Interface
CSP	Communications Service Provider
D&I	Decoupling & Integration
DC	Data Centre
DCN	Data Communication Network
DE	Decision Element
DPRA	Digital Platform Reference Architecture
DTN	Data Transfer Node
EACM	Enterprise Architecture Content Metamodel
EGM	Engagement Management
ETSI	European Telecommunications Standards Institute



# Architecture: Decoupled and Modular Systems

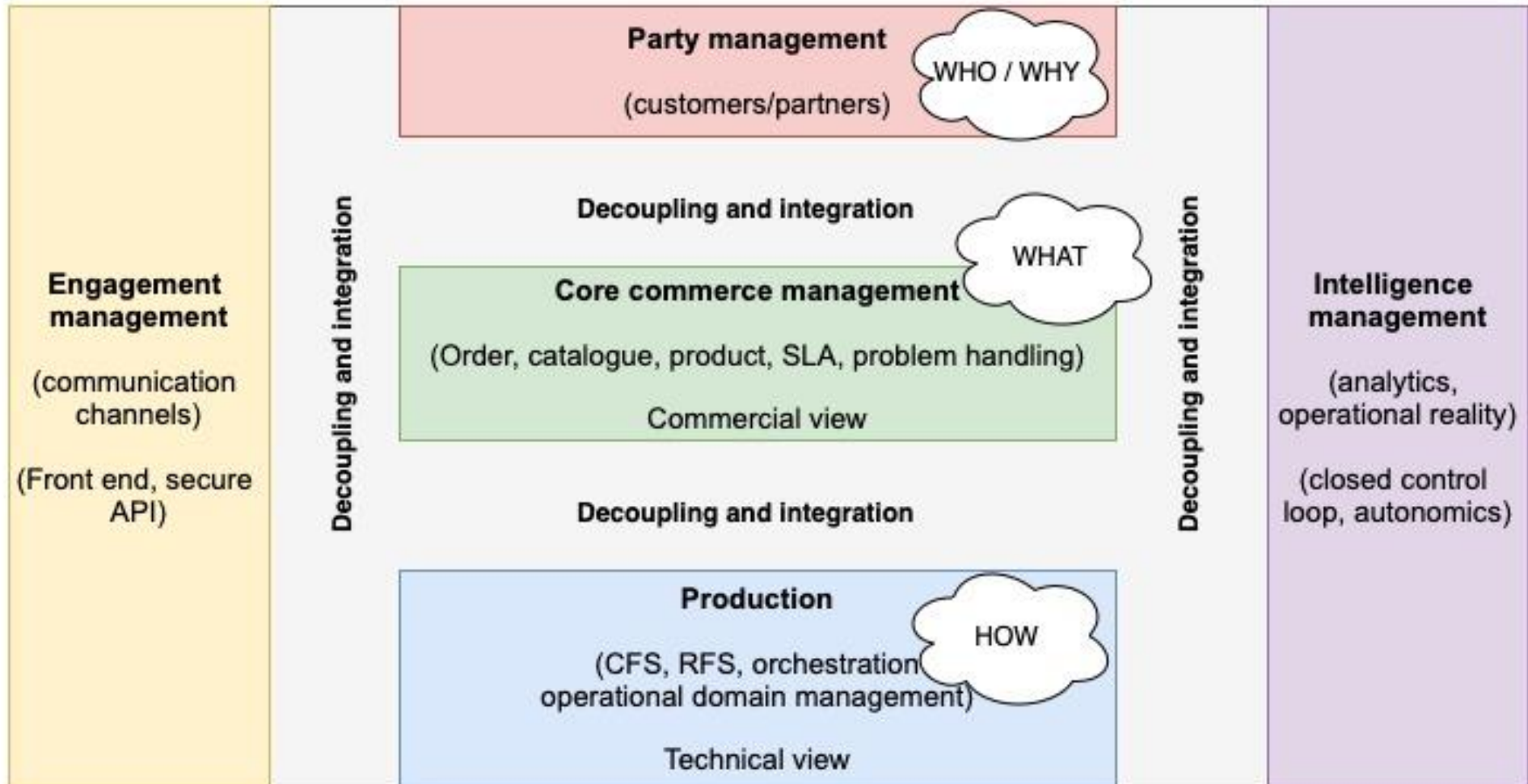


## Architecture - The Vegas Rule





# Architecture Blueprint: TM Forum Open Digital Architecture



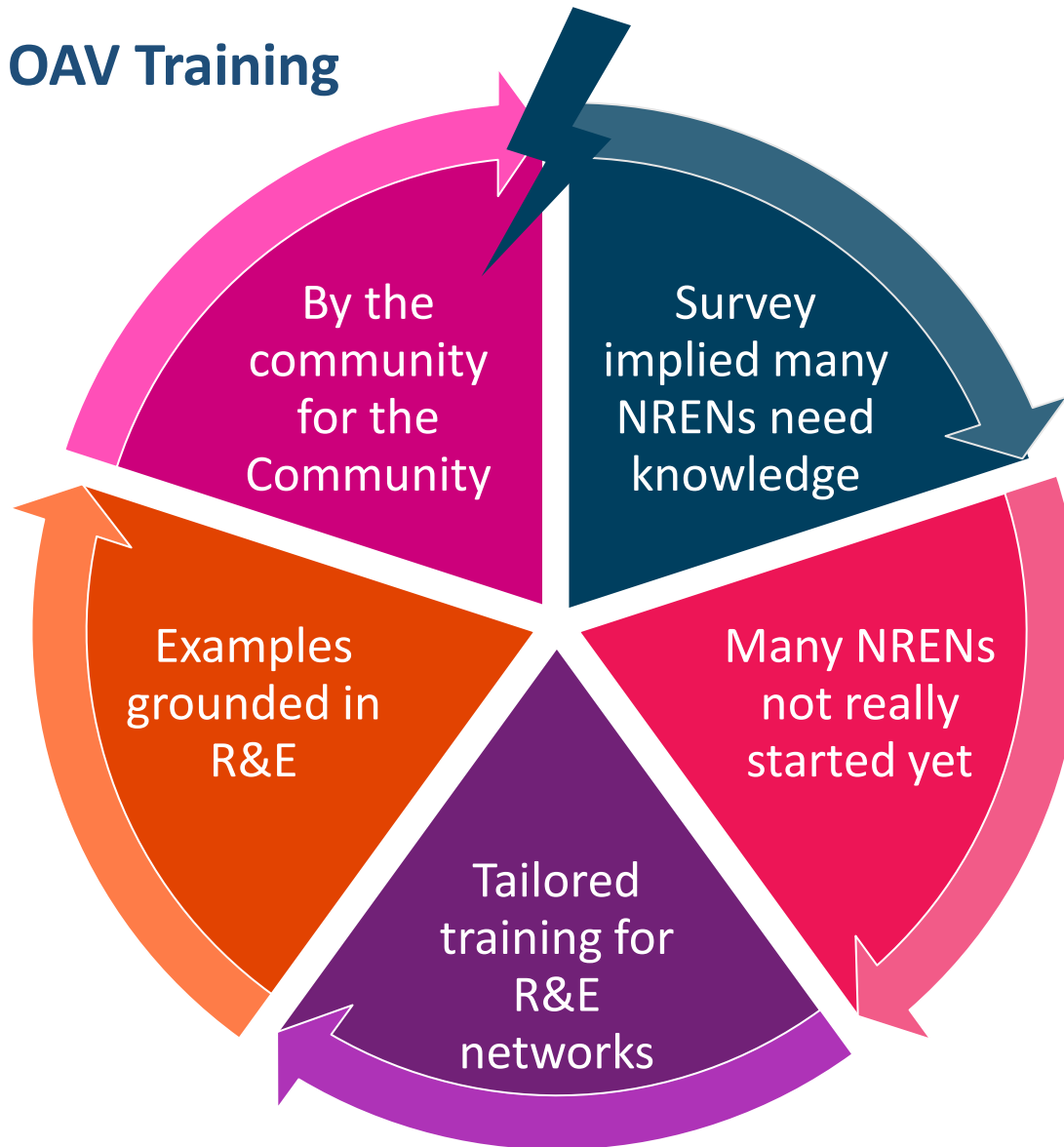
People

Organizations

Things



## Training: The Need for OAV Training



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# OAV Training: Knowledge Map

## Introduction

DevOps Concepts

Decoupling and  
Integration

Standards and  
Commonly Used  
Architectures

Engagement  
Management

Production

Core  
Commerce  
Management

Party  
Management

Intelligence  
Management

NREN Implementation Examples

TMForum Open Digital Architecture Functional Blocks

Mapping of Architectures

[www.geant.org](http://www.geant.org)



# The OAV Training Portal – The Network Automation eAcademy

Panel / NETDEV Home / OAV

## OAV Training Portal

Creado por Susanne Naegele-Jackson, modificado por última vez hace 2 horas

This Training Portal is offering courses focused on the research and education community, with external references that can be useful for us and examples that can be closer to our use cases. It is training by the community for the community. The portal will have new classes available for you to explore every couple of weeks; all classes are online courses that you can follow and complete at your own pace.

### Courses in Network Automation eAcademy

Introduction	TM Forum Open Digital Architecture	ADDITIONAL READING
<ul style="list-style-type: none"><li>• <a href="#">OAV - Introduction</a></li><li>• <a href="#">OAV Architecture Requirements for NRENS</a></li><li>• <a href="#">The OAV Architecture Blueprint</a></li></ul>	<ul style="list-style-type: none"><li>• Decoupling &amp; Integration<ul style="list-style-type: none"><li>• <a href="#">Introduction to Data Modelling, Data Formats, and Protocols</a></li><li>• <a href="#">Data Modelling: YANG</a></li><li>• <a href="#">Formats: YAML</a></li><li>• <a href="#">Formats: JSON</a></li><li>• <a href="#">Introduction to API</a></li></ul></li><li>• Engagement Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Engagement Management</a></li></ul></li><li>• Party Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Party Management</a></li></ul></li><li>• Core Commerce Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Core Commerce Management</a></li></ul></li><li>• Production<ul style="list-style-type: none"><li>• <a href="#">Introduction to Automation</a></li><li>• <a href="#">Introduction to Configuration Management</a></li></ul></li><li>• Intelligence Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Intelligence Management</a></li></ul></li></ul>	<ul style="list-style-type: none"><li>• <a href="#">CARNET</a></li><li>• <a href="#">CYNET</a></li><li>• <a href="#">GRNET (coming soon)</a></li><li>• <a href="#">HEAnet</a></li><li>• <a href="#">SURFNET</a></li></ul>
<h3>DevOps</h3> <ul style="list-style-type: none"><li>• <a href="#">Introduction to CI/CD</a></li></ul>	<h3>Architectures</h3> <ul style="list-style-type: none"><li>• <a href="#">GVM</a></li><li>• <a href="#">SENSE</a></li><li>• <a href="#">SPA</a></li></ul>	<p>Meet us on the first Tuesday of every month One hour for questions &amp; answers Just drop us an email at <a href="mailto:oav@lists.geant.org">oav@lists.geant.org</a> and we will send you the link.</p>

# The Network Automation eAcademy

← → ↻ https://e-academy.geant.org/moodle/ 90% ☆

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GEANT LEARNING & DEVELOPMENT

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# The Network Automation eAcademy

Seleccione su proveedor de identidad

English | Bokmål | Nynorsk | Sámeigiella | Dansk | Deutsch | Español | Svenska | Suomeksi | Français | Italiano | Nederlands | Lëtzebuergesch | Čeština | Slovenščina | Hrvatski | Magyar | Język polski | Português | Türkçe | 日本語 | 繁體中文 | ελληνικό | Lietuvių kalba | русский язык




Imagen al azar TNC2013 en Maastricht

All eduGAIN φEDUrus Chile Spain UKfederation US Italy NZ AU NL **Social networks**

Guest providers Miscellaneous

Incremental search...

29 Mayis University  
A'SHARQIYAH UNIVERSITY  
A\*STAR - Agency for Science, Technology and Research  
A. T. Still University  
AAF Virtual Home  
aai.lab.maeen.sa

# The Network Automation eAcademy

Seleccione su proveedor de identidad

English | Bokmål | Nynorsk | Sámeigiella | Dansk | Deutsch | Español | Svenska | Suomeksi | Français | Italiano | Nederlands | Lëtzebuergesch | Čeština | Slovenščina | Hrvatski | Magyar | Język polski | Português | Türkçe | 日本語 | 繁體中文 | ελληνικά | Lietuvių kalba | русский язык




Imagen al azar TNC2013 en Maastricht

All | eduGAIN | φEDUrus | Chile | Spain | UKfederation | US | Italy | NZ | AU | NL | Social networks

Guest providers | Miscellaneous

Incremental search...

- Bitbucket
- Facebook
- Google
- Linkedin
- Twitter
- Yahoo!



# The Network Automation eAcademy

Home


Dashboard

More...


Learning tags

Browse courses

Glad Calendar



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GÉANT LEARNING & DEVELOPMENT



All Courses

Welcome to GÉANT eAcademy!

To access eAcademy, please, use "Log in" area in the upper right corner and select your choice of authentication.

To navigate the available courses, please click 'All Courses' button.

There is also a "Get inspired" dynamics newsfeed. Make sure to visit it to get ideas and stay on top of industry news.


Happy learnings!

Network Automation eAcademy

Training programme 'by the community and for the 'community' for engineers, managers, researchers, and members of the R&E networking community who want to know more about orchestration, automation and virtualisation (OAV).

The **Network Automation eAcademy** offers a series of courses aimed at the development of technical knowledge and skills associated with managing complex related tasks and workflows.

(New courses are being released on a regular basis)





- Home
- Dashboard
- More...
- Learning tags
- Browse courses
- Glad Calendar

# GÉANT eAcademy

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

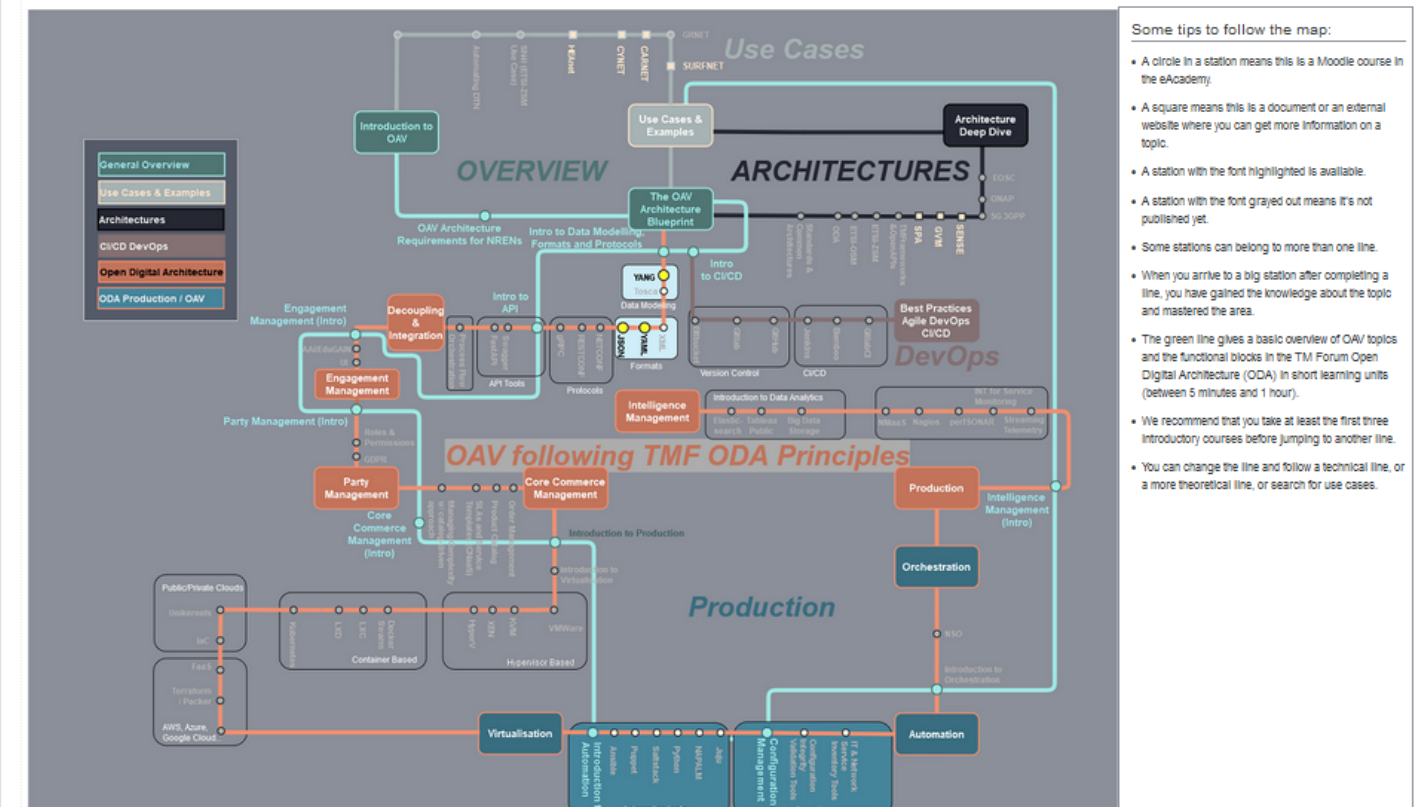
Course categories: Technical skills / Network / Network Automation eAcademy

## Network Automation eAcademy

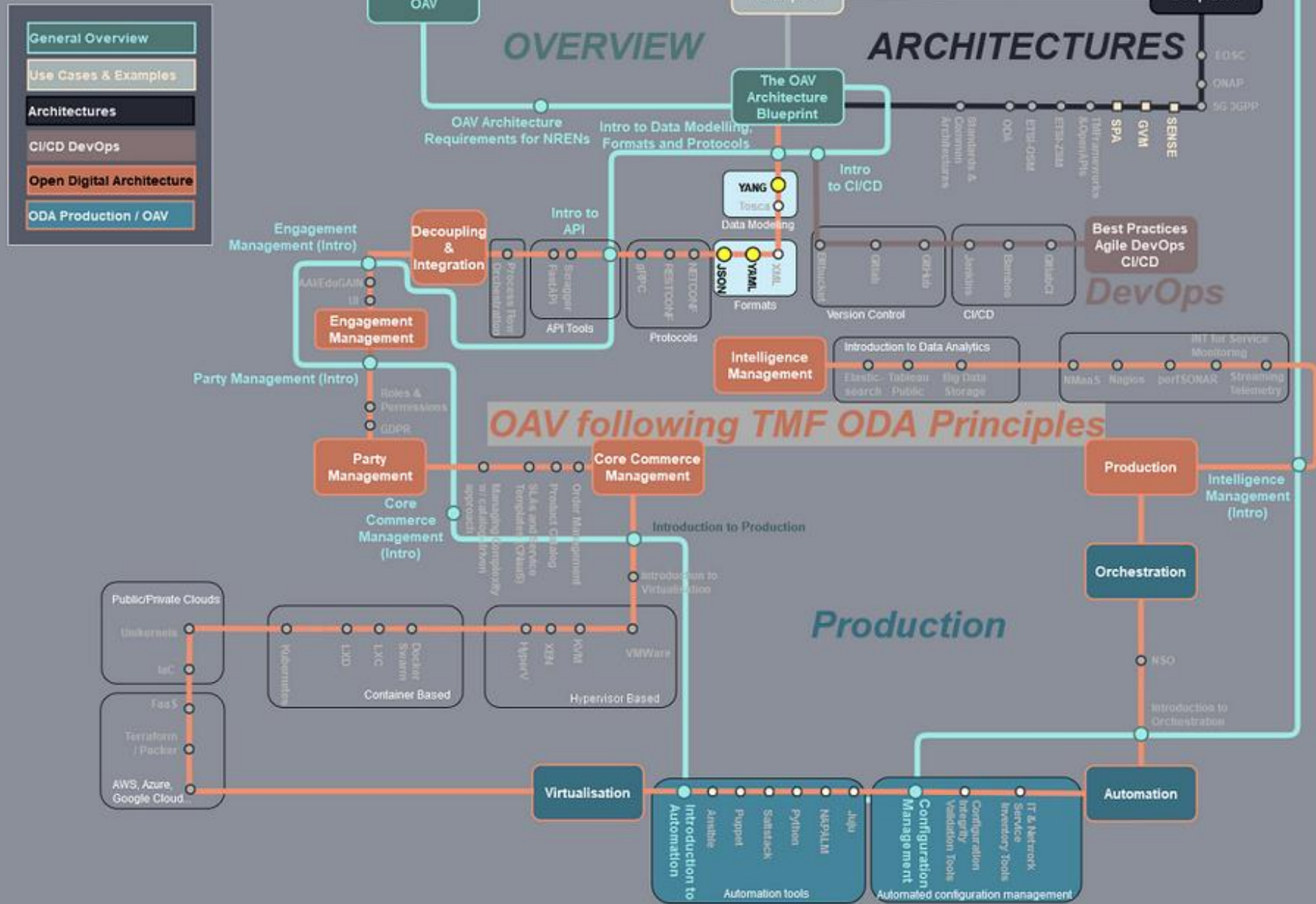
Orchestration, Automation and Virtualisation (OAV) are broad topics with many tools, platforms, programming languages and concepts involved, and it's easy to get lost. The interactive metro map below will help you find your way depending on your areas of interests.

### Follow the Metro map!

(OAV Interactive Metro map: click on areas of interest to select courses)



# OAV Training Map



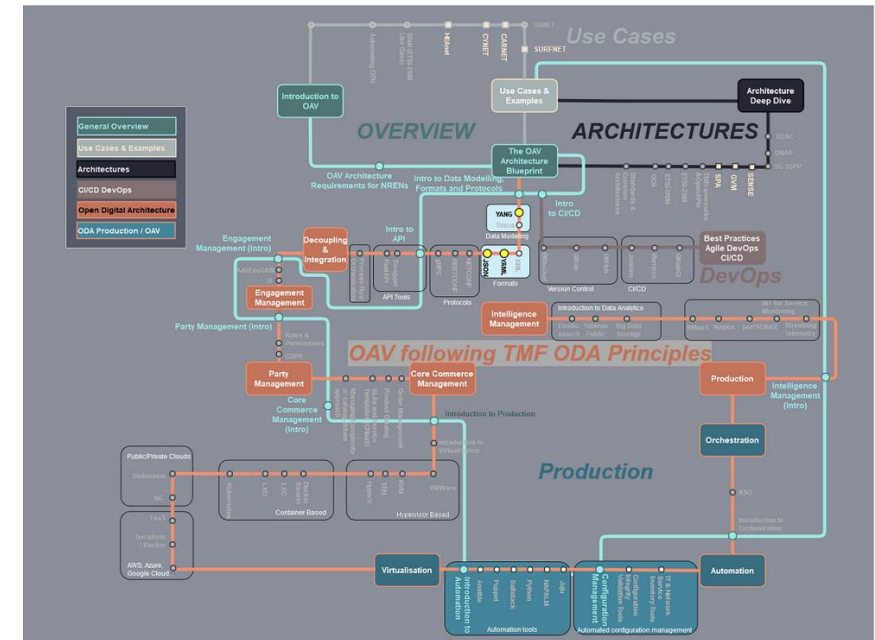
## Your Trainers

Jasone Astorga (RedIRIS / UPV/EHU)	Xavier Jeannin (RENATER)
Estela Carmona (RedIRIS / i2CAT)	Hamzeh Khalili (RedIRIS/i2CAT)
Dónal Cunningham (HEAnet)	Roman Łapacz (PSNC)
Yuri Demchenko (SURFnet / UvA)	Anastas Mishev (UKIM/MARNET)
Aleksandra Dedinec (UKIM/MARNET)	Susanne Naegele-Jackson (DFN / FAU)
Martin Dunmore (Jisc)	Simone Spinelli (GÉANT)
Sonja Filiposka (MARNET / USC)	Kostas Stamos (GRNET / CTI)
Maria Isabel Gandia (RedIRIS/CSUC)	Pavle Vuletić (AMRES)
Eduardo Jacob (RedIRIS / UPV/EHU)	
Iacovos Ioannou (CyNet)	



# The Introductory Line (General Overview)

- [OAV Introduction](#)
- [OAV Architecture Requirements for NRENs](#)
- [The OAV Architecture Blueprint](#)
- [Introduction to CI/CD](#)
- [Introduction to data modelling, data formats and protocols](#)
- [Introduction to API](#)
- [Introduction to Engagement Management](#)
- [Introduction to Party Management](#)
- [Introduction to Core Commerce Management](#)
- Introduction to Production
- [Introduction to Automation](#)
- [Introduction to Configuration Management](#)
- Introduction to Orchestration
- [Introduction to Intelligence Management](#)





# The Open Digital Architecture “Introductory Pack”

- [OAV Architecture Requirements for NRENs](#)
- [The OAV Architecture Blueprint](#)
- [Introduction to Engagement Management](#)
- [Introduction to Party Management](#)
- [Introduction to Core Commerce Management](#)
- Introduction to Production
- [Introduction to Intelligence Management](#)





# Cherry-pick

https://e-academy.geant.org/moodle/course/index.php?categoryid=20 67% ☆

Search courses  Go


Available courses

**Manual**

**Automated**


OAV - Introduction (1.1)

Category: Network Automation eAcademy



OAV architecture requirements for NREs (1.2)

Category: Network Automation eAcademy



The OAV Architecture Blueprint (1.3 / 2.1 / 3.1)

Category: Network Automation eAcademy


**Build**

**Release**

**Operate**


CI/CD - Introduction (1.4 / 3.2)

Category: Network Automation eAcademy



Data modelling, data formats and protocols - Introduction (1.5 / 2.2)

Category: Network Automation eAcademy




API - Introduction (1.6 / 2.11)

Category: Network Automation eAcademy

**YAML**


Formats: YAML (2.6)

Category: Network Automation eAcademy




Formats: JSON (2.7)

Category: Network Automation eAcademy




YANG - Data modelling (2.3)

Category: Network Automation eAcademy




Engagement Management - Introduction (1.7 / 2.15)

Category: Network Automation eAcademy




Core Commerce Management - Introduction (1.9)

Category: Network Automation eAcademy




Party Management - Introduction (1.8)

Category: Network Automation eAcademy




Intelligence Management - Introduction (1.14 / 2.38)

Category: Network Automation eAcademy



Automation - Introduction (1.11 / 2.26)

Category: Network Automation eAcademy



Configuration Management - Introduction (1.12 / 2.33)

Category: Network Automation eAcademy

# Example – Formats: YAML

## Formats: YAML (2.6)

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

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

Welcome to the Course: Formats: YAML



COURSE DATE:



From September 2021

DURATION:



20 min

COMMITMENT:



30 min

REQUIREMENT:



No requirements

COURSE TYPE:



Selfpaced

CREDENTIAL:



Certificate of completion

Learning path:	OAV Training Portal
Preceded by:	Data Modelling: YANG
Followed by:	Formats: JSON

### Course summary

YAML is a human-friendly data serialisation standard broadly used in Orchestration. This page contains useful tips and references and a quiz.

30



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# Example – Formats: YAML

## Formats: YAML (2.6)

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

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

Please watch the video below to learn about YAML and see several examples of usage in OAV.

(In case you want to turn on the auto-generated subtitles, press the "CC" icon in the bottom of the image while you are reproducing the video. For a more accurate text reading, you can also download the PDF with the notes.)

### Numbers

- YAML supports:

- Integer: decimal, hexadecimal (0x), octal (0).
- Floating point: fixed and exponential, including .inf, -.inf, .nan

```
device:
  name: "MyOAVdevice\n"
  "@id": 0xC
  interfaces: 4
  version: "1.41"
  working: true
  vendor: MyOAV vendor - awesome!
  site: https://www.example.com
```

in quotes in the example - because we want it to be considered a string and not a number.

Subtitulos (c)  
www.geant.org



# Example – Formats: YAML

## Formats: YAML (2.6)

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

### Formats: YAML

18 de 20

Tamaño automático

#### Real-world YAML example : setting interface descriptions using Ansible

```
# Playbook to include descriptions for router interfaces
- hosts: core
  tasks:
    - name: Describe router interfaces using ios.interface
      ios_interface:
        name: "{{ item.name }}"
        description: "{{ item.description }}"
        state: present
        provider: "{{ credentials }}"
      with_items:
        - { name: Ethernet0/0, description: "Transit Provider 1" }
        - { name: Ethernet0/1, description: "Transit Provider 2" }
```

You can find `ios_interface` in <https://galaxy.ansible.com/>

www.geant.org



Let's take an example from an Ansible playbook that can be used to set descriptions for the interfaces of a Cisco router running IOS.

This playbook would be used with the module `ios_interface` that you can find in Ansible Galaxy.

You can learn more about modules, inventories and playbooks in the Ansible learning unit.

Let's start with the content marked in red. Here, we have the first item of a sequence

# Example – Formats: YAML

## Formats: YAML (2.6)

[Home](#) > [My courses](#) > [Technical skills](#) > [Network](#) > [Network Automation eAcademy](#) > [Formats: YAML](#) > [Useful Links](#)

[OVERVIEW](#) [Main Goals](#) [Formats: YAML](#) [Useful Links](#) [Quiz](#) [Feedback & Certificate](#)

Read the specs:

- [YAML Specifications v1.2](#)

Use a YAML validator before using a configuration file. Some online tools to debug your YAML syntax:

- [Online YAML Tools](#)
- [YAML Lint](#)

Use an editor with a plugin extension for your editor (or YAML mode):

- [ATOM](#)

GNU Emacs with yaml-mode:

- [Simple major mode to edit YAML file for emacs](#)

JSON to YAML converter:

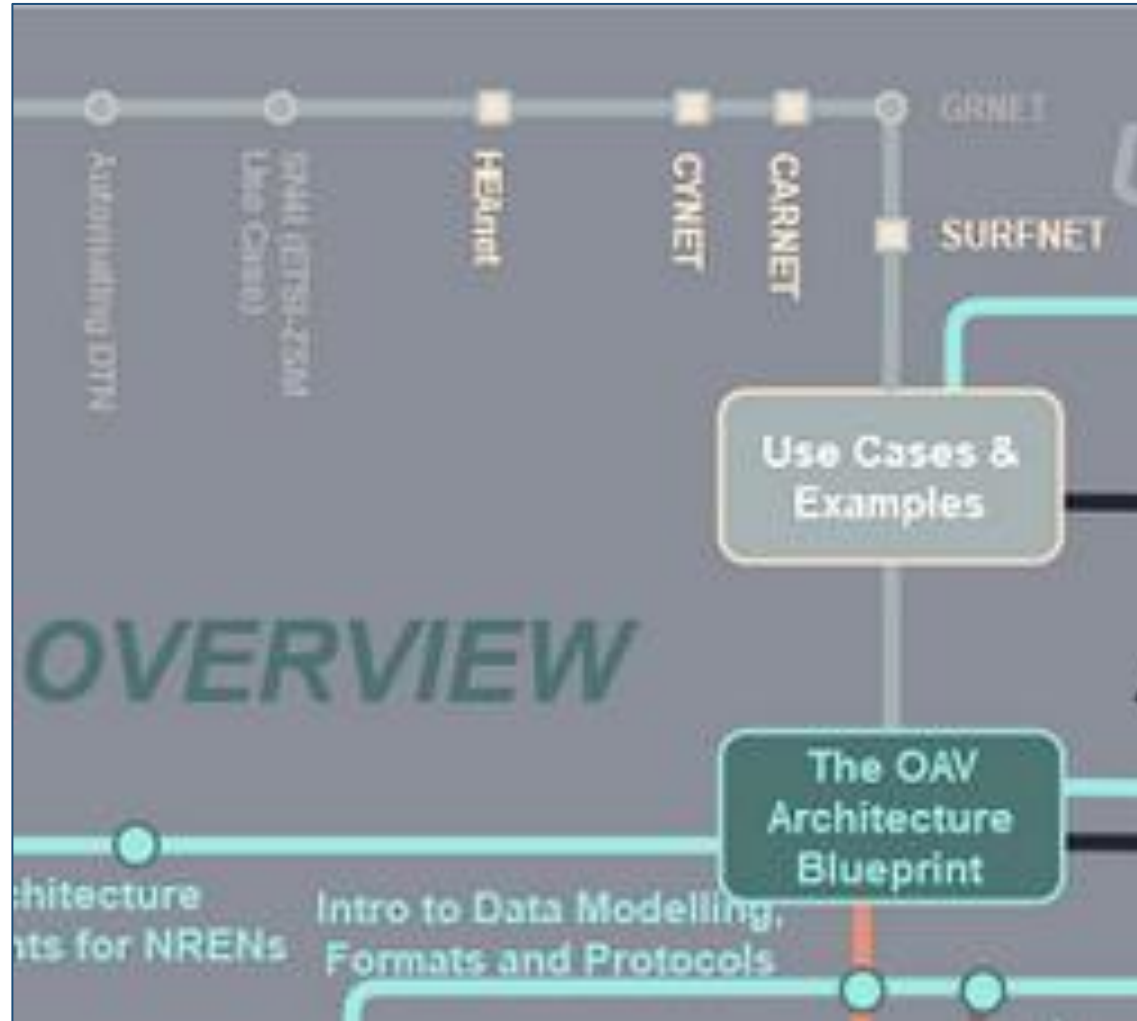
- [JSON to YAML Converter](#)

Ansible documentation:

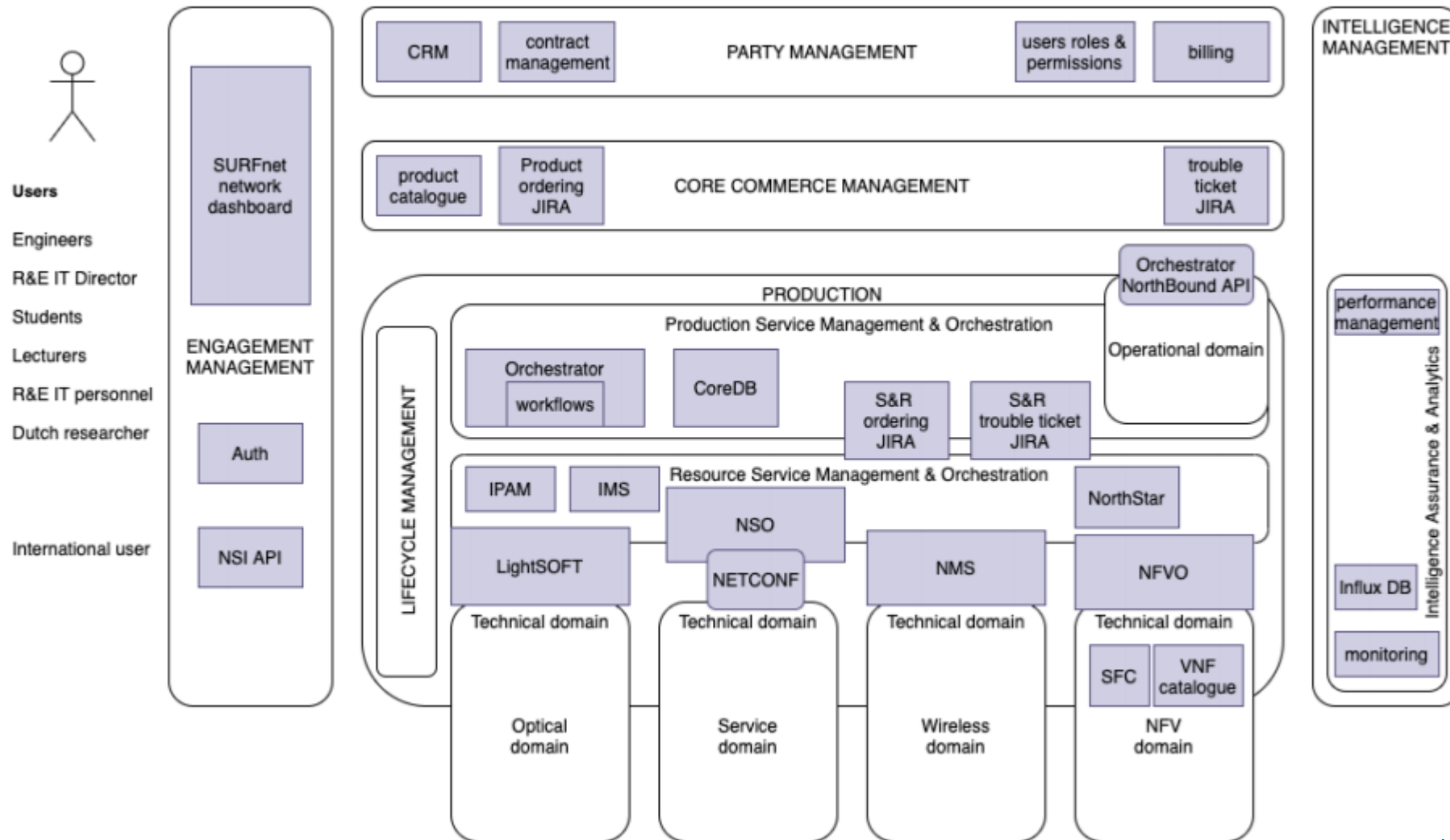
- [YAML Syntax](#)
- [Ansible Galaxy](#)



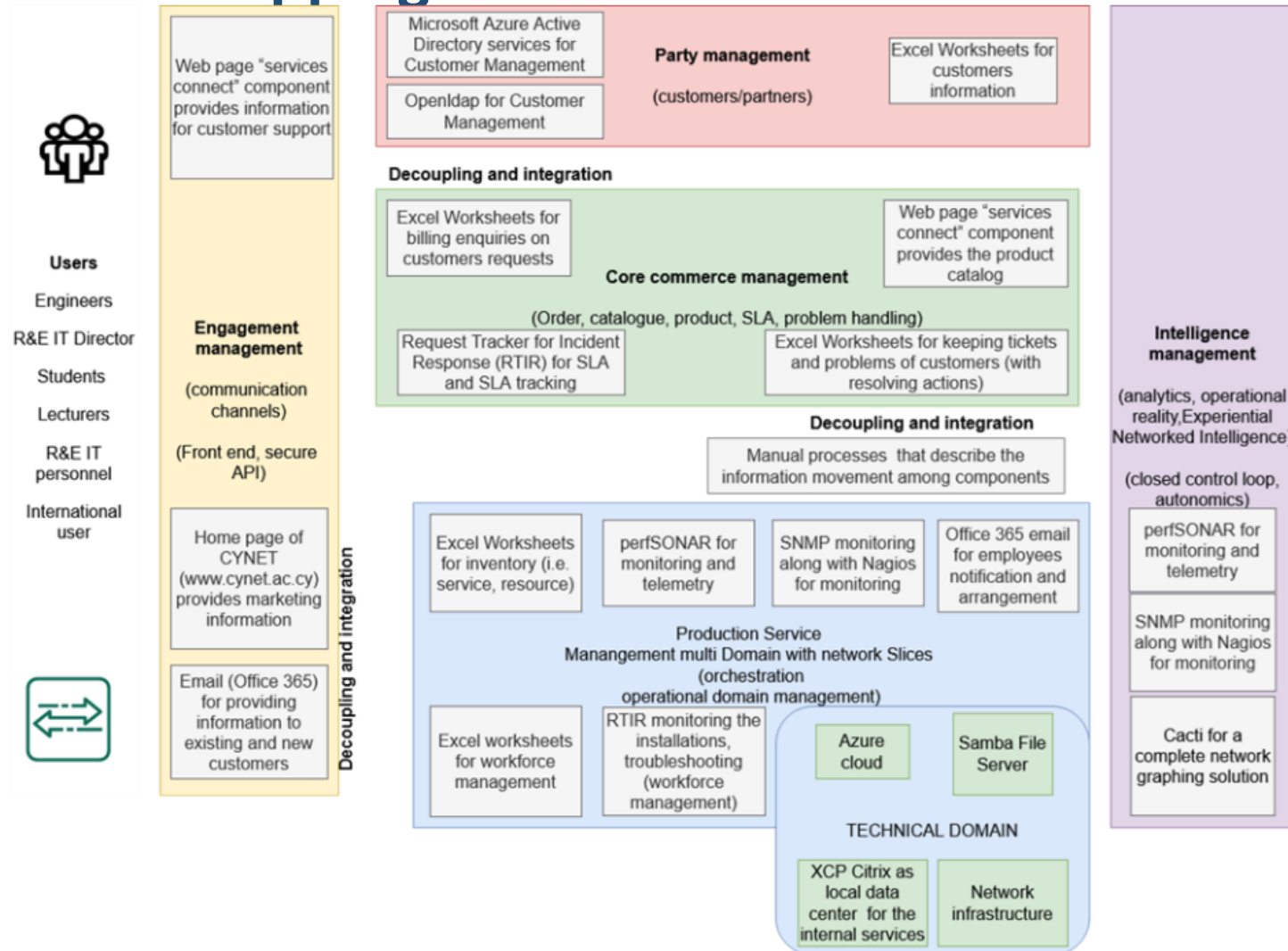
# Use Cases: Mapping Architectures to the Blueprint



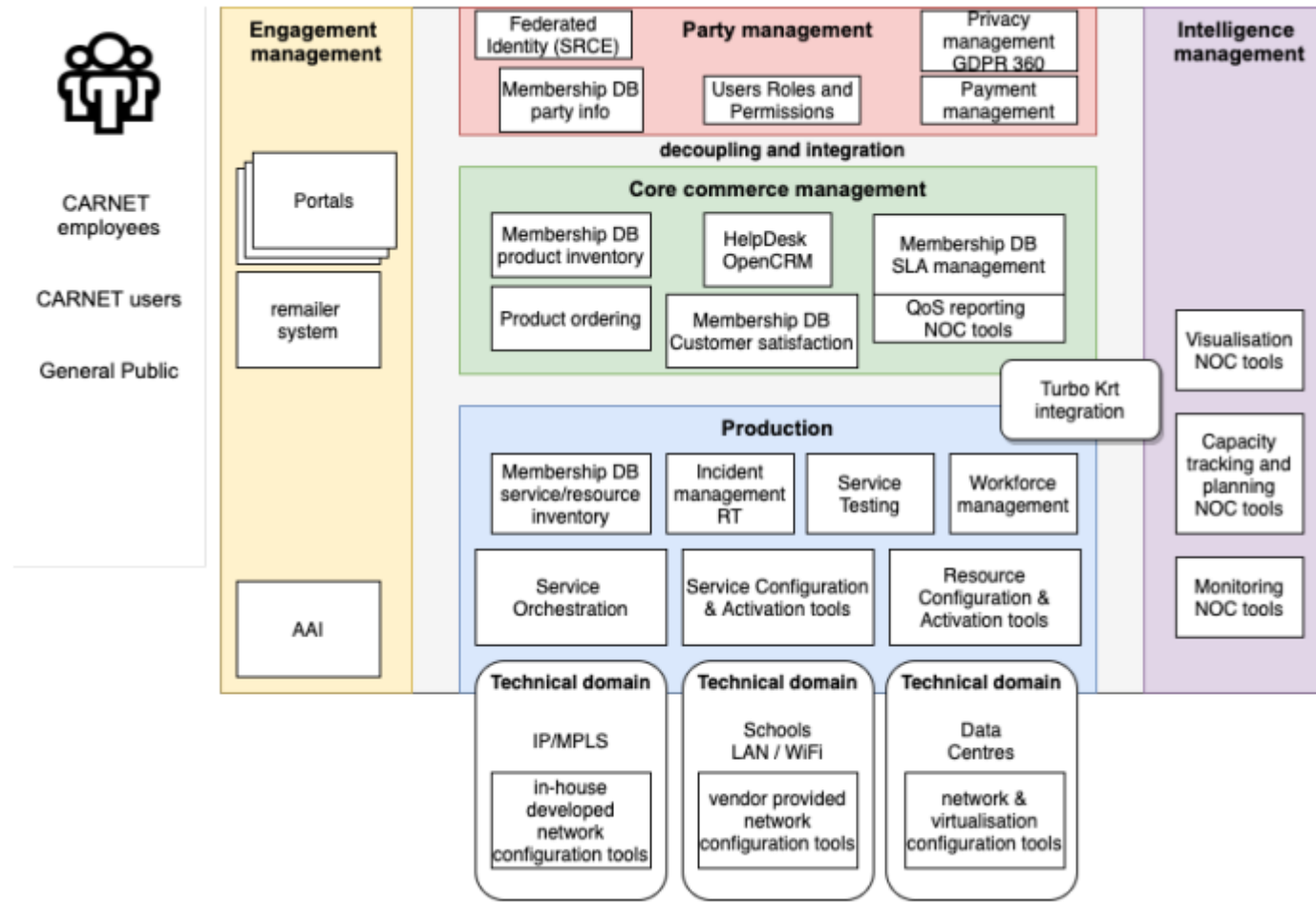
# Architecture Mappings: SURF



# Architecture Mappings: CYNET

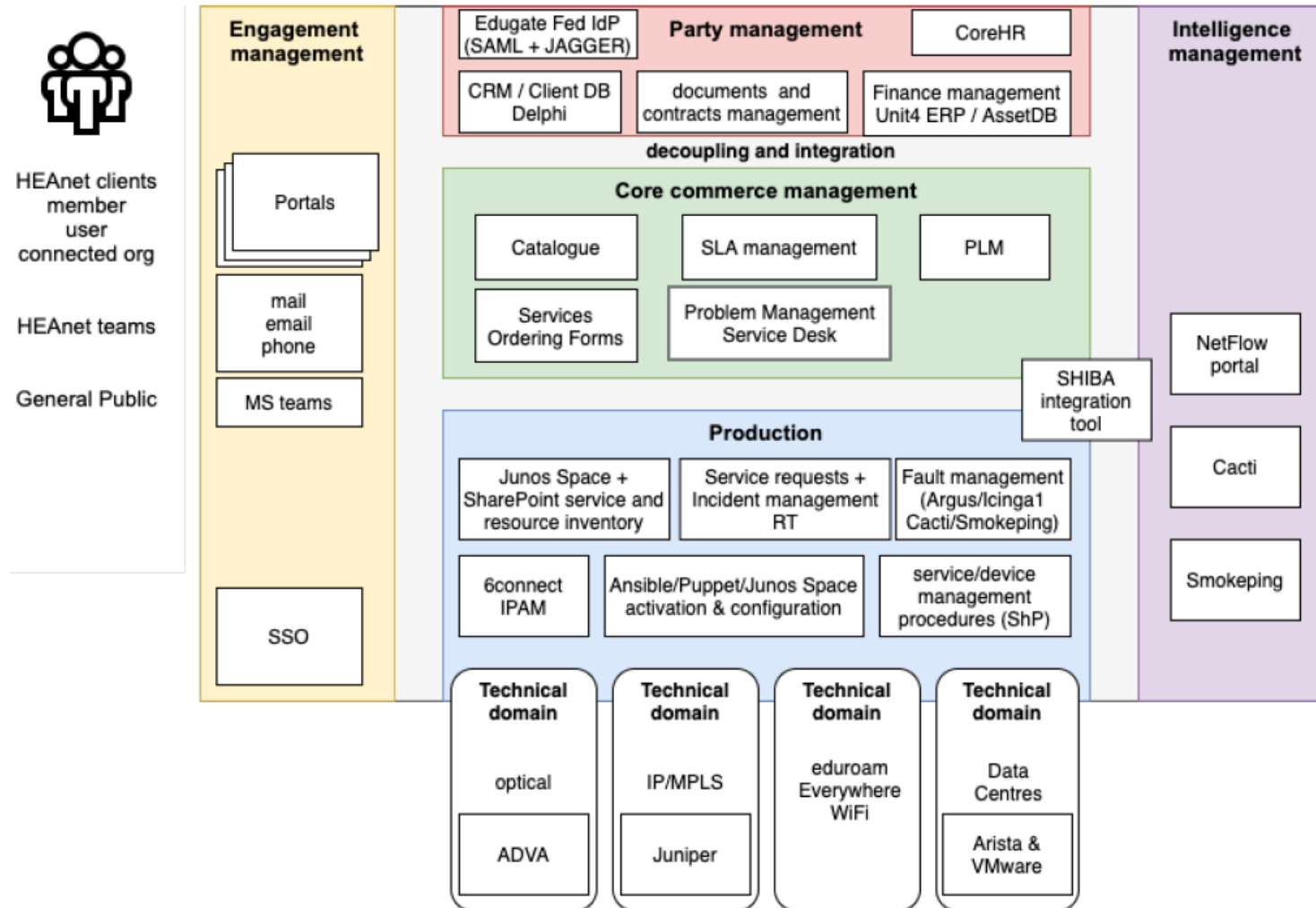


# Architecture Mappings: CARNET







# Architecture Mappings: HEAnet




# Open Window to the Trainers

- By video conference on the first Tuesday every month.


Panel / NETDEV Home / OAV  

## OAV Training Portal

Creado por Susanne Naegle-Jackson, modificado por última vez hace 5 horas




This Training Portal is offering courses focused on the research and education community, with external references that can be useful for us and examples that can be closer to our use cases. It is training by the community for the community. The portal will have new classes available for you to explore every couple of weeks; all classes are online courses that you can follow and complete at your own pace.

 Info | [Infoshares ++](#) | [Events](#)

- [all upcoming and past events](#)

### Courses in Network Automation eAcademy

<b>Introduction</b> <ul style="list-style-type: none"><li>• <a href="#">OAV - Introduction</a></li><li>• <a href="#">OAV Architecture Requirements for NRENS</a></li><li>• <a href="#">The OAV Architecture Blueprint</a></li></ul>	<b>TM Forum Open Digital Architecture</b> <ul style="list-style-type: none"><li>• Decoupling &amp; Integration<ul style="list-style-type: none"><li>• <a href="#">Introduction to Data Modelling, Data Formats, and Protocols</a></li><li>• <a href="#">Data Modelling: YANG</a></li><li>• <a href="#">Formats: YAML</a></li><li>• <a href="#">Formats: JSON</a></li><li>• <a href="#">Introduction to API</a></li></ul></li><li>• Engagement Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Engagement Management</a></li></ul></li><li>• Party Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Party Management</a></li></ul></li><li>• Core Commerce Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Core Commerce Management</a></li></ul></li><li>• Production<ul style="list-style-type: none"><li>• <a href="#">Introduction to Automation</a></li><li>• <a href="#">Introduction to Configuration Management</a></li></ul></li><li>• Intelligence Management<ul style="list-style-type: none"><li>• <a href="#">Introduction to Intelligence Management</a></li></ul></li></ul>	<b>ADDITIONAL READING</b> <b>NREN Architecture Mappings</b> <ul style="list-style-type: none"><li>• <a href="#">CARNET</a></li><li>• <a href="#">CYNET</a></li><li>• <a href="#">GRNET</a> (coming soon)</li><li>• <a href="#">HEAnet</a></li><li>• <a href="#">SURFNET</a></li></ul> <b>Architectures</b> <ul style="list-style-type: none"><li>• <a href="#">GVM</a></li><li>• <a href="#">SENSE</a></li><li>• <a href="#">SPA</a></li></ul>
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Meet us on the first Tuesday of every month  
One hour for questions & answers  
Just drop us an email at [oav@lists.geant.org](mailto:oav@lists.geant.org) and we will send you the link.

# Thank you

Any questions?

Or email us:

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