



Open Source
MANO



5GZORRO

Zero-touch security and trust for ubiquitous computing and connectivity
in 5G networks

Marketplace-driven 5G network slices among multiple operators in 5GZORRO

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OSM Ecosystem Day, 01 Dec 2021

NEXTWORKS
HEADING THE FUTURE

5GZORRO platform overview

- Rationale and Concept
- Functionalities

Product lifecycle management

- Orchestration workflow from the Marketplace to the deployment in NFVI

OSM in 5GZORRO

- OSM support to the different orchestration phases

The current 5G context

- Still suffering lack of pervasiveness due to the very low capability of establishing network slices and relative services across different domains
- Quite static and mostly 1:1 relationships among 5G actors (Telcos, VNF/CNF vendors, Infra owners)
 - Long time to define bilateral agreements and then deploy them
 - Limited number of actors involved
 - Prospective high CAPEX for 5G networks if cannot use resources/assets by different providers



The technical progresses in orchestration of network services and network slices risk to be limited by the current business model

Overview: Why 5GZORRO (2)

Need to:

- Enhance the way the different parties conduct business with each other
 - I.e. faster, trusted, secure and automatic (zero-touch) online negotiations and agreements
- Evolve the concept of Network Resource to include computing, transport, storage, radio and spectrum
 - Creation of new specialized network stakeholders as a consequence

A proper framework is needed to provide the required business support to the current orchestration technology

The H2020 5GZORRO Project aims to provide such a framework

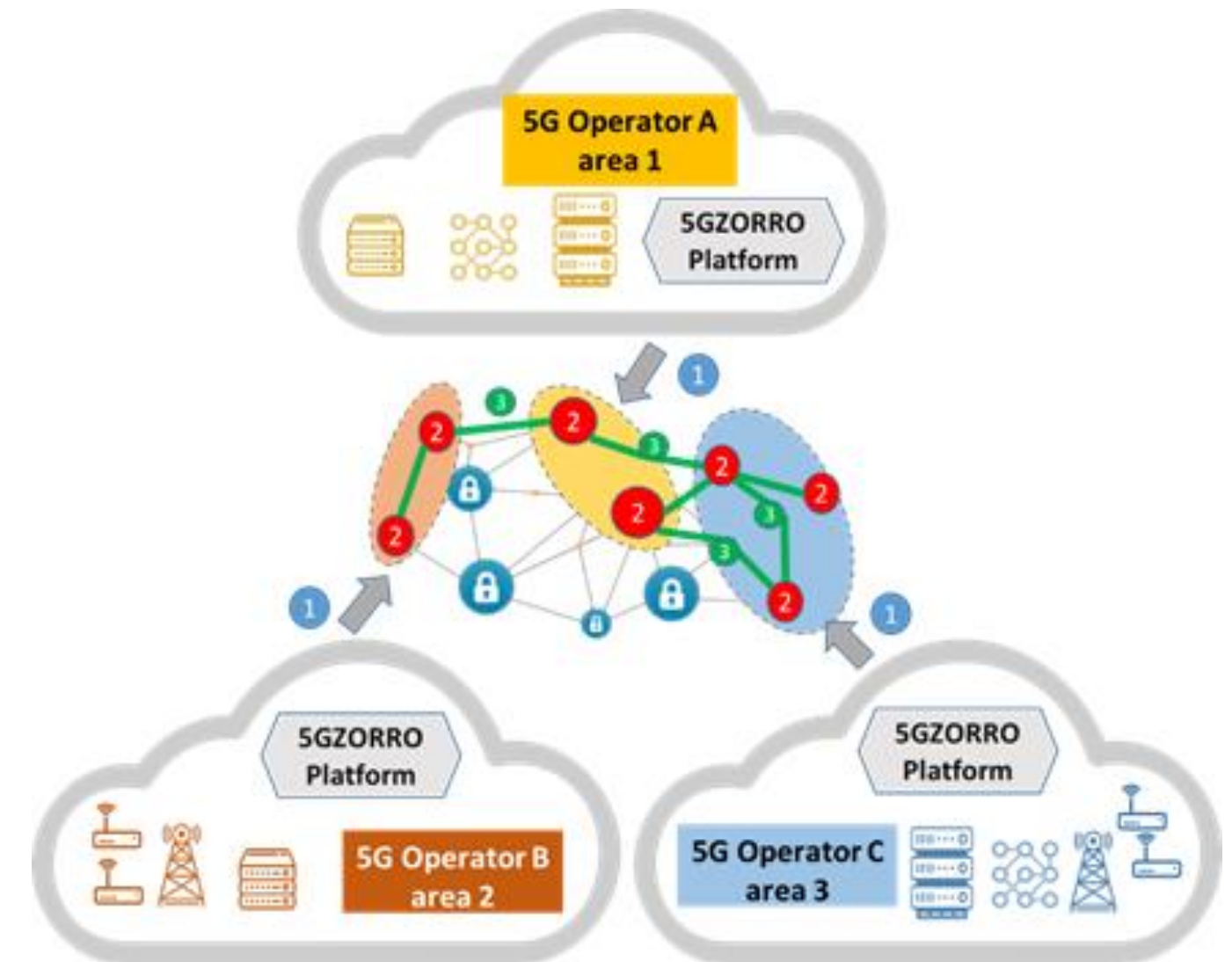
5GZORRO Goal and Concept

Design and implement a platform to offer services and tools to

- select and trade resources, slices and services from different providers
- establish business relationships exploiting automatic and secure procedures

Concept

- 1 Operators use 5GZORRO **DLT-Based marketplace** to publish and to search for new resources
- 2 The framework intelligence automatically selects proper resources
- 3 Resource usage and chaining is automatically formalized through the mechanism of the **Smart Contracts**

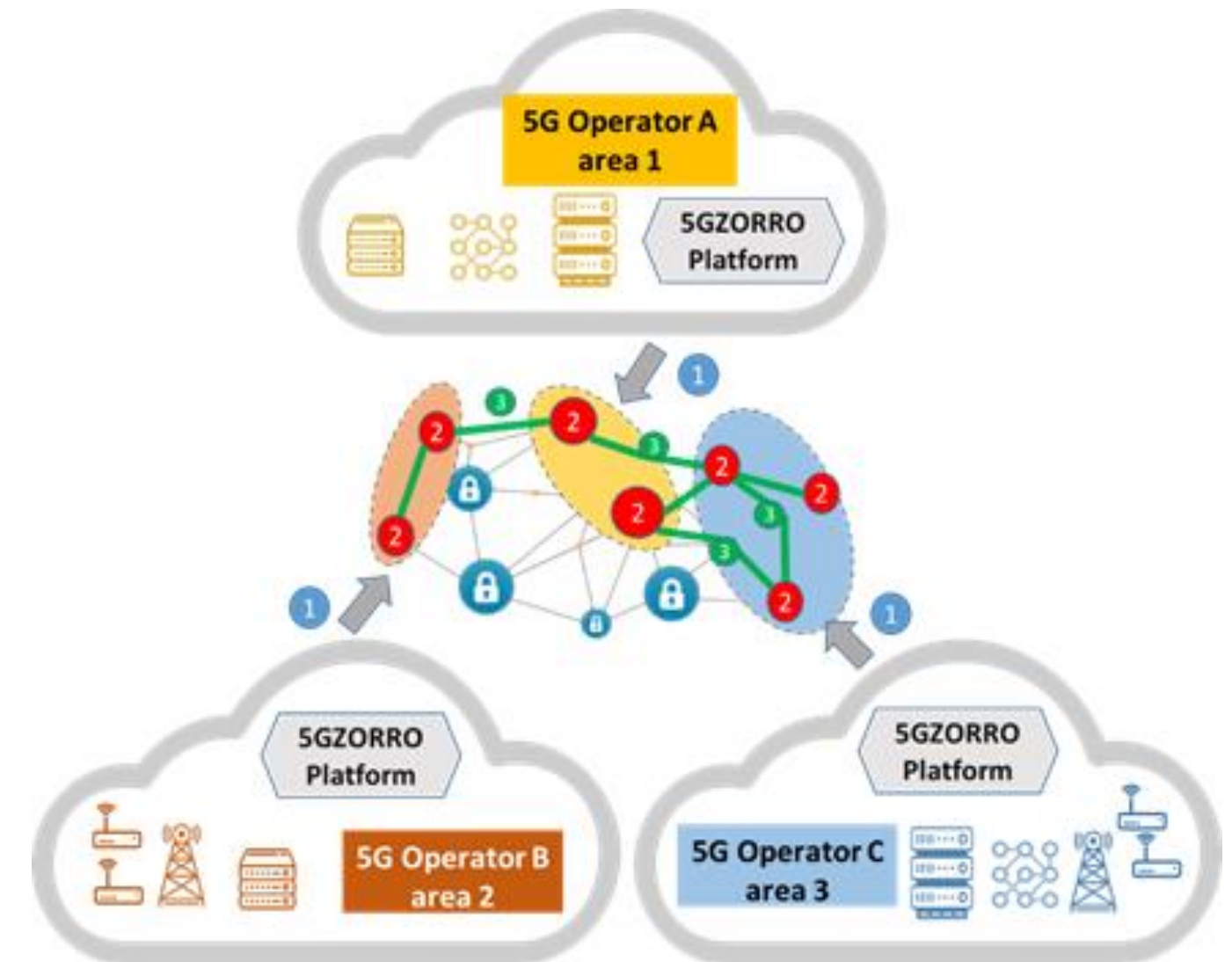


Not only a 5G Marketplace: 5GZORRO Services

5GZORRO provides **Marketplace** + a set of mechanisms to guarantee **security, trust and automation** among domains

5GZORRO Services

- Cross-domain network slicing with zero-touch lifecycle management
- Resource and service offering via marketplace
- Discovery, intelligent selection and trading of Resources and Services via Smart Contracts
- Cross-stakeholder e-license management
- SLA monitoring & breach prediction
- Security and trust across multiple domains



5GZORRO Platform composition

Artifacts logically grouped in 4 sub-platforms

Marketplace

- Management of digital products and smart contracts, intelligent resource discovery

Zero-touch Service Management and Orchestration

- Secure and Trust Business-oriented and Service Orchestration, eLicensing management

Governance

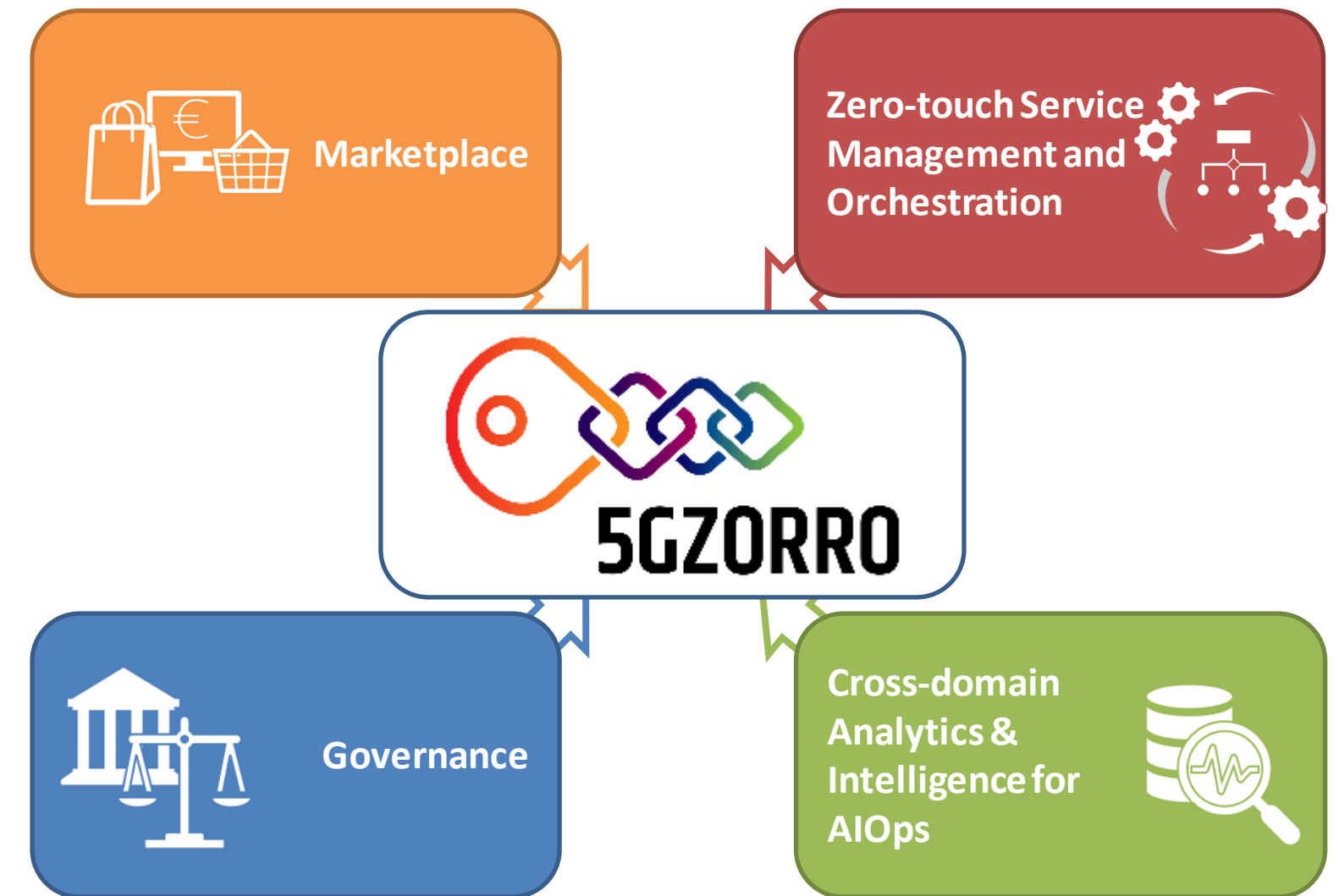
- Entities (Stakeholder, Resource, Service and Products) identity management, legal prose management

Cross-domain Analytics & Intelligence for AIOps

- Datalake and intelligent data analysis

Different Stakeholders use different deployment models

- i.e. regulator, Network Operator, VNF/CNF provider, etc.



5GZORRO Zero-touch Orchestration platform

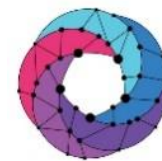
Modeled as a Two-layers stack

[new] Business relationship establishment via Marketplace

- Capture Stakeholders' **high-level requirements**
- Select the proper products from the Marketplace
- Invoke **Products' Orchestration** after the formalization of the proper **Smart Contract(s)**

[usual] Products' Deployment/Orchestration

- Lifecycle management of **Network Services** and **Slices** on the basis of technical **specification/description** (e.g., 3GPP NSTs, **ETSI SOL-006 NSDs**, etc.)
- Direct interaction with the Virtualized Infrastructure layer **Orchestrators** and **VIMs** (e.g., **OSM**, K8s, OpenStack, etc.)



Security and Trust integrated with orchestration

- Support of Slice/Service Orchestration on NFVI with **TEE support** based on **Intel SGX guard**
- Intra-domain secure monitoring
- Trust and Reputation Management
 - Stakeholder reputation calculation and **Trust Score** assignment
- Secure Cross-Domain Connectivity
 - Establishment of **Cross-domain VPN connection** based on **WireGuard**





5GZORRO Marketplace platform

Enable secure resource sharing and trading exploiting DLT/BC Technologies

- R3 Corda DLT/BC technology to guarantee **secure transactions**
 - Once a **Product Offer** is created and placed into the DLT, it becomes **immutable**
 - The **Smart Contract** generated once the product is traded is also registered in the DLT and becomes **immutable** as well



A Product Offer cannot be tampered after the product acquisition via 5GZORRO Marketplace

Marketplace object definitions based on standard models from TM Forum

- TMF620 - Product Catalog Management
- TMF622 - Product Ordering
- TMF633 - Service Catalog Management
- TMF634 - Resource Catalog Management





5GZORRO Marketplace platform (2)

5GZORRO Products

- Trading of different types of services and resources
 - Compute, Storage and Service Resources, **Network Services, Virtual Functions, Network slices**, etc.
 - Also Network Slices in Marketplace:
 - **product** or **composition** of **products** shared in the Marketplace

Trading of Licensed Spectrum via “Spectoken”

- Spectokens are **non-fungible** tokens represent the **rights** to use a **certain interval of spectrum** in a location over a duration of time and will be available for sale and trading by appropriately **permissioned 5GZORRO users**
- **National Spectrum regulation authorities validate any spectrum offers and transactions**

An example Storyline

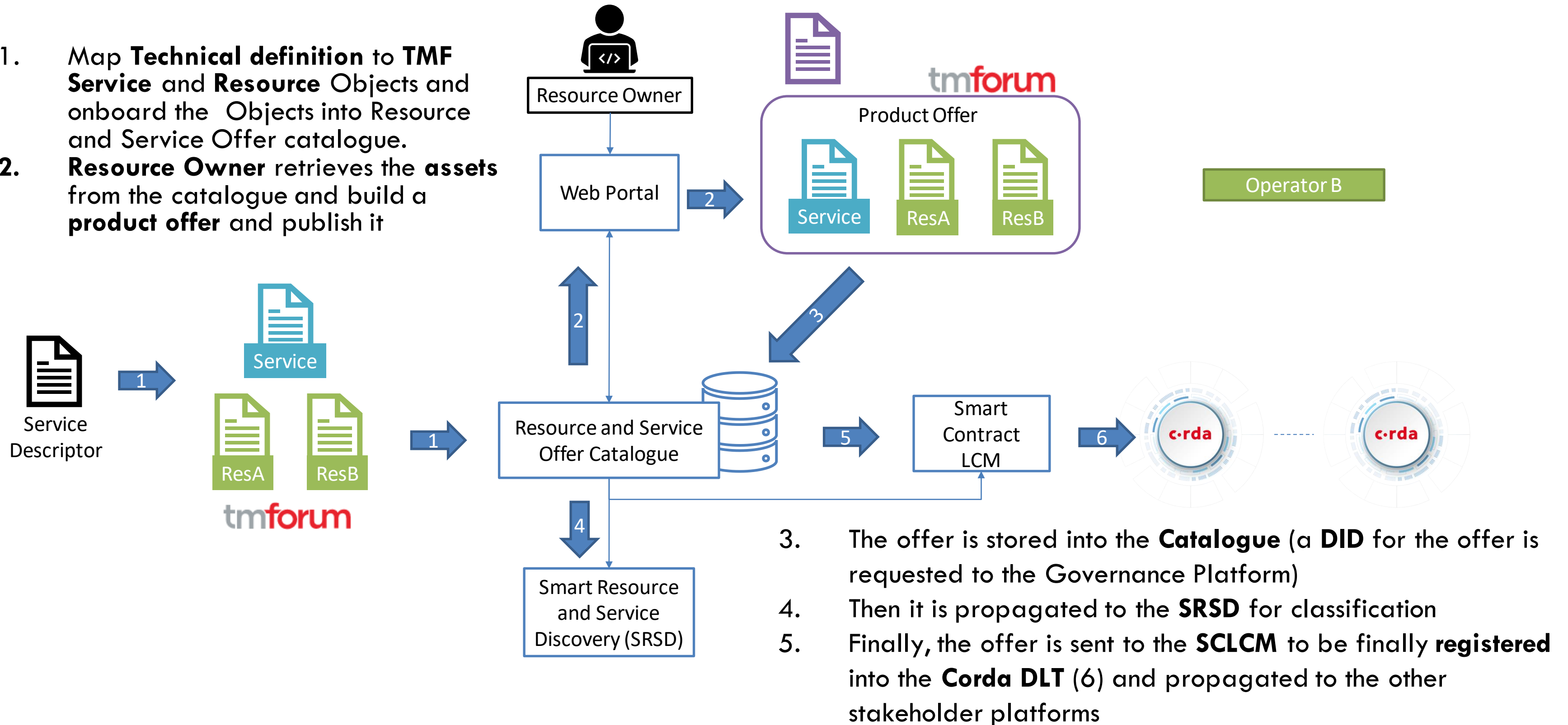
- Two Network Stakeholders
 - Operator A and Operator B
- **Operator B** creates and publishes an offer in the 5GZORRO Marketplace for a **Network Service** (e.g., vCDN cache)
- **Operator A** discovers the offer, purchases it and deploys the service

Demo videos available on 5GZORRO YouTube channel

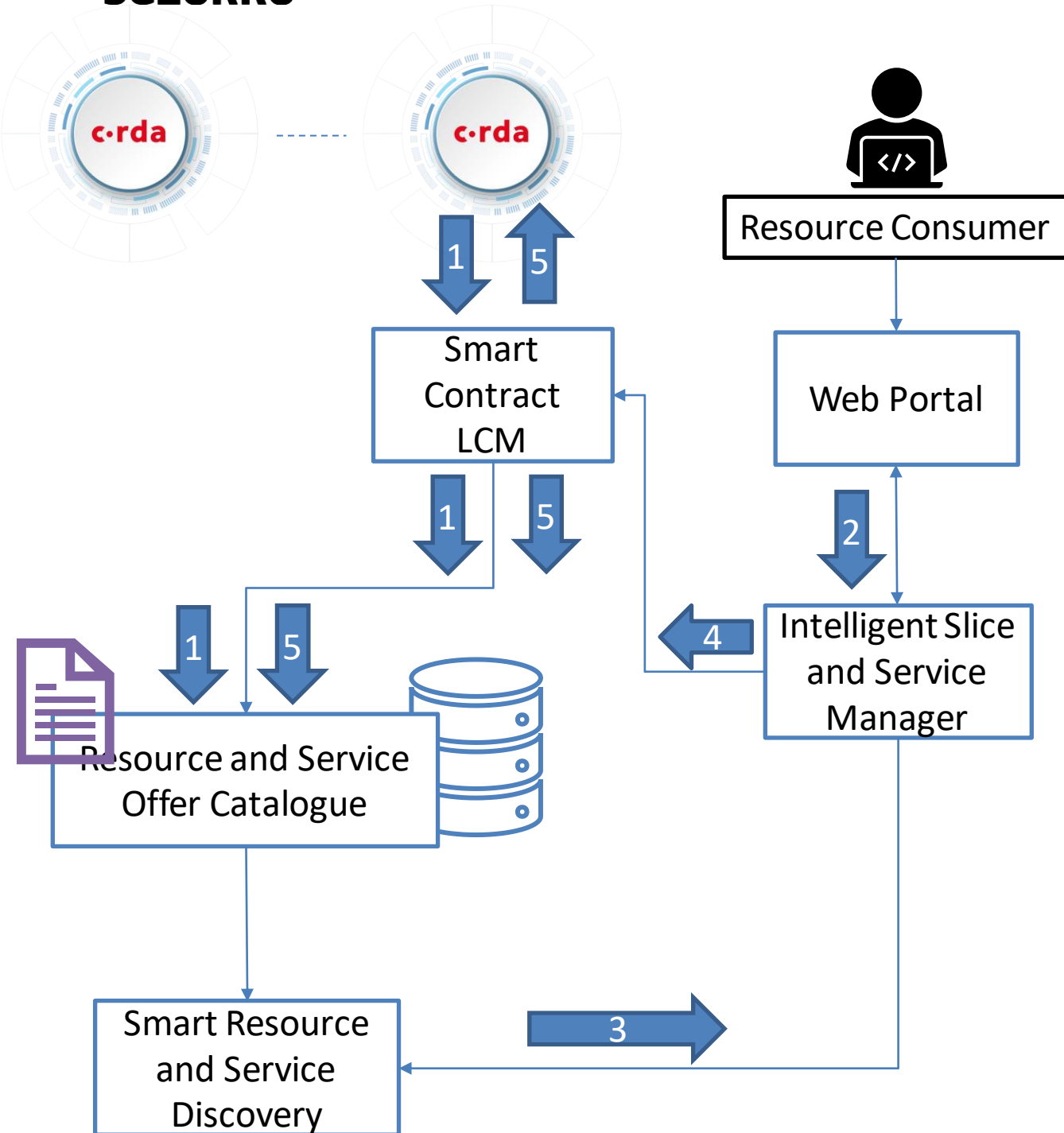
- *From product offers to offer selection in 5GZORRO Marketplace*
 - <https://www.youtube.com/watch?v=XkBYRrmvcoU>
- *Multi-operator Network Slicing with SLA breach prediction*
 - <https://www.youtube.com/watch?v=fFLs4EiHAqU&t=1s>

5GZORRO Product Lifecycle Management (2)

1. Map **Technical definition** to **TMF Service** and **Resource** Objects and onboard the Objects into Resource and Service Offer catalogue.
2. **Resource Owner** retrieves the **assets** from the catalogue and build a **product offer** and publish it



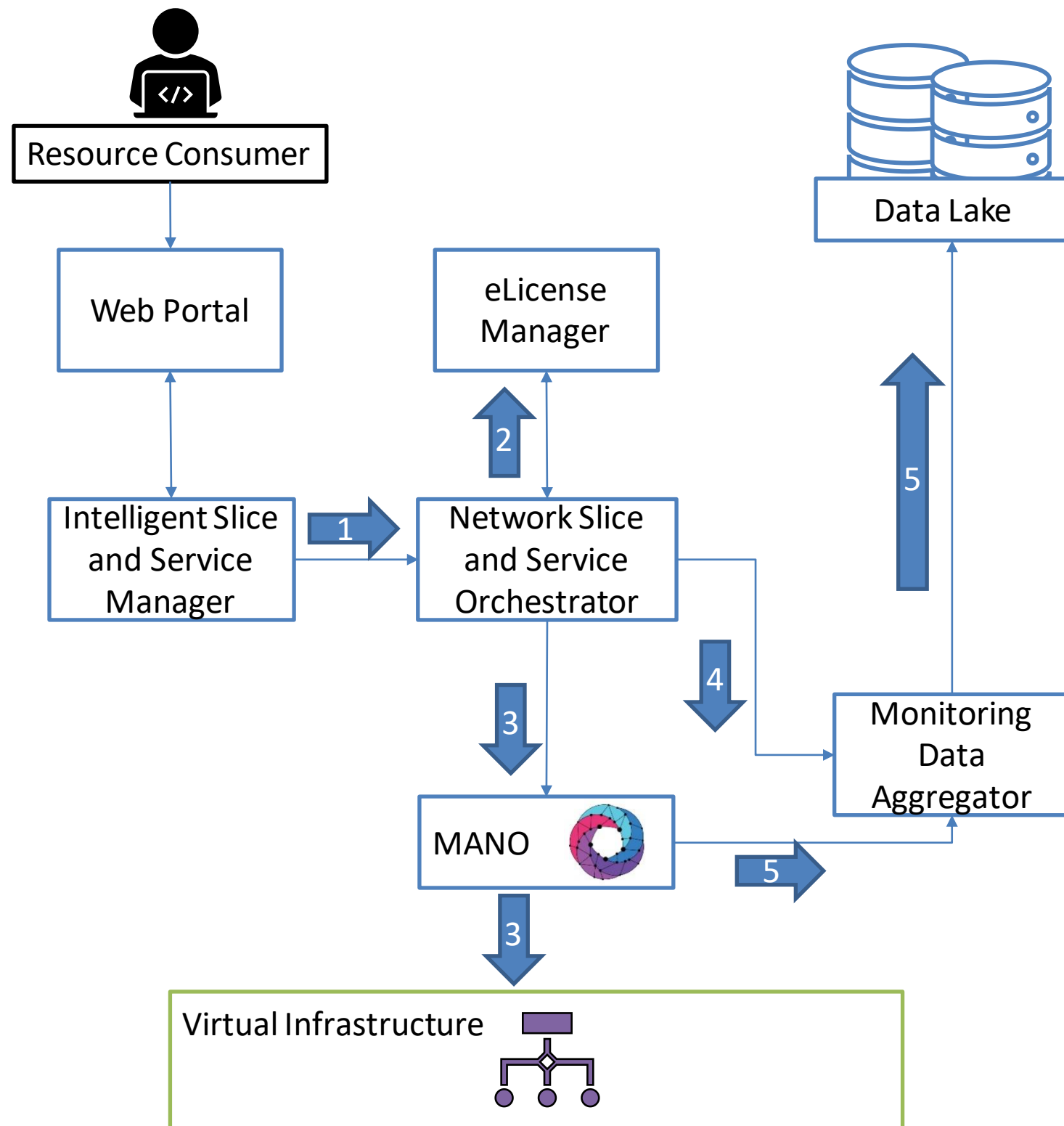
5GZORRO Product Lifecycle Management (3)



Operator A

1. Local SCLCM **collects new offers from the DLT** and stores them into the local catalogue.
2. A **Resource Consumer** accesses the Web Portal looking for service with certain characteristics
3. The **ISSM** retrieves from the **SRSD** products **matching the requirements** best-match ranked. An internal ISSM optimization process can change the ranking
4. **ISSM** invokes the **SCLCM** to start the purchasing process
5. **SCLCM** creates a **Smart Contract** to be registered in the **DLT** and a **Product Order** to be stored in the **Catalogue**

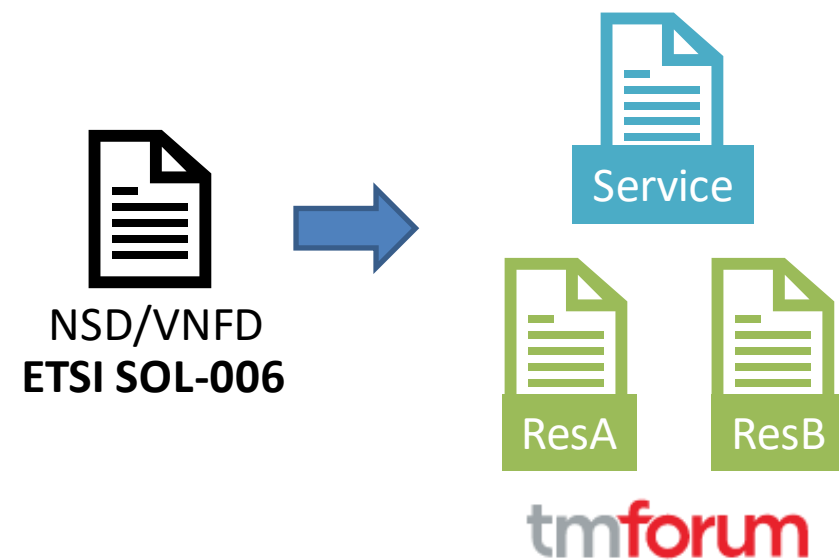
5GZORRO Product Lifecycle Management (4)



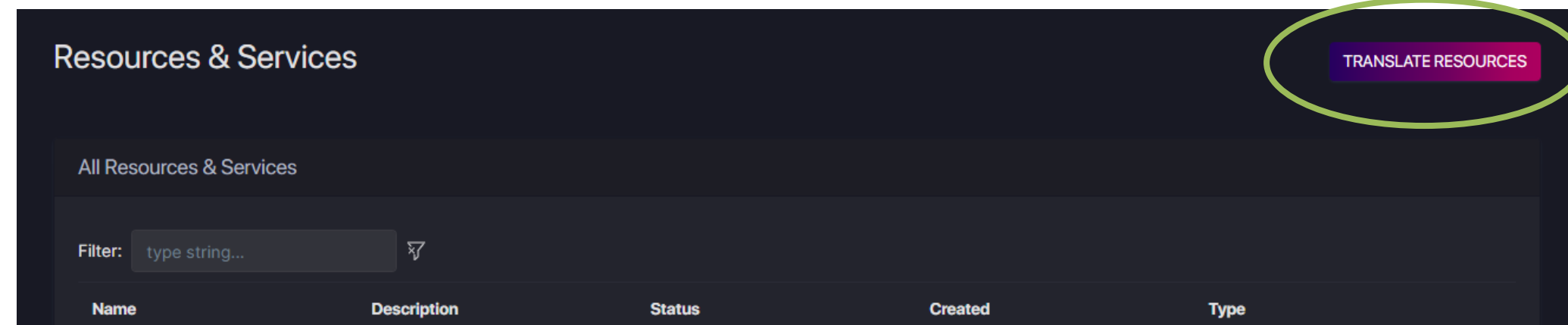
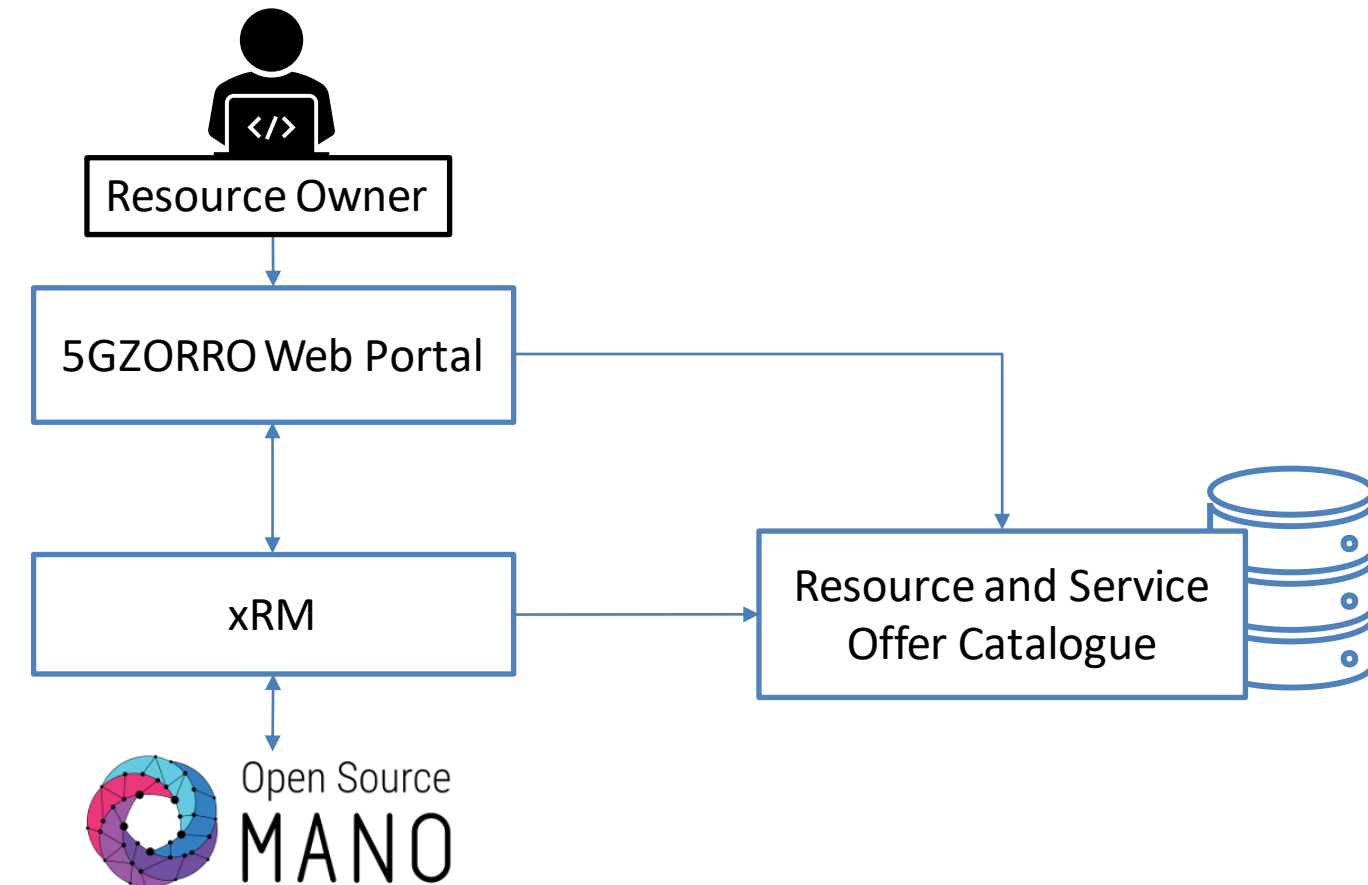
Operator A

1. The **ISSM** invokes the **NSSO** to **instantiate** the purchased product
2. The **NSSO** verifies the **licensing terms** of the product with the **eLicensing Manager** before invoking the MANO (OSM)
3. The **NSSO** invokes the underlying MANO (**OSM**) to instantiate the Network Service
4. After the instantiation the **NSSO** configures the **Monitoring Data Aggregator** to collect metrics related to the service
5. The **MDA** collects the metrics, aggregates and sends them to the **Data Lake**

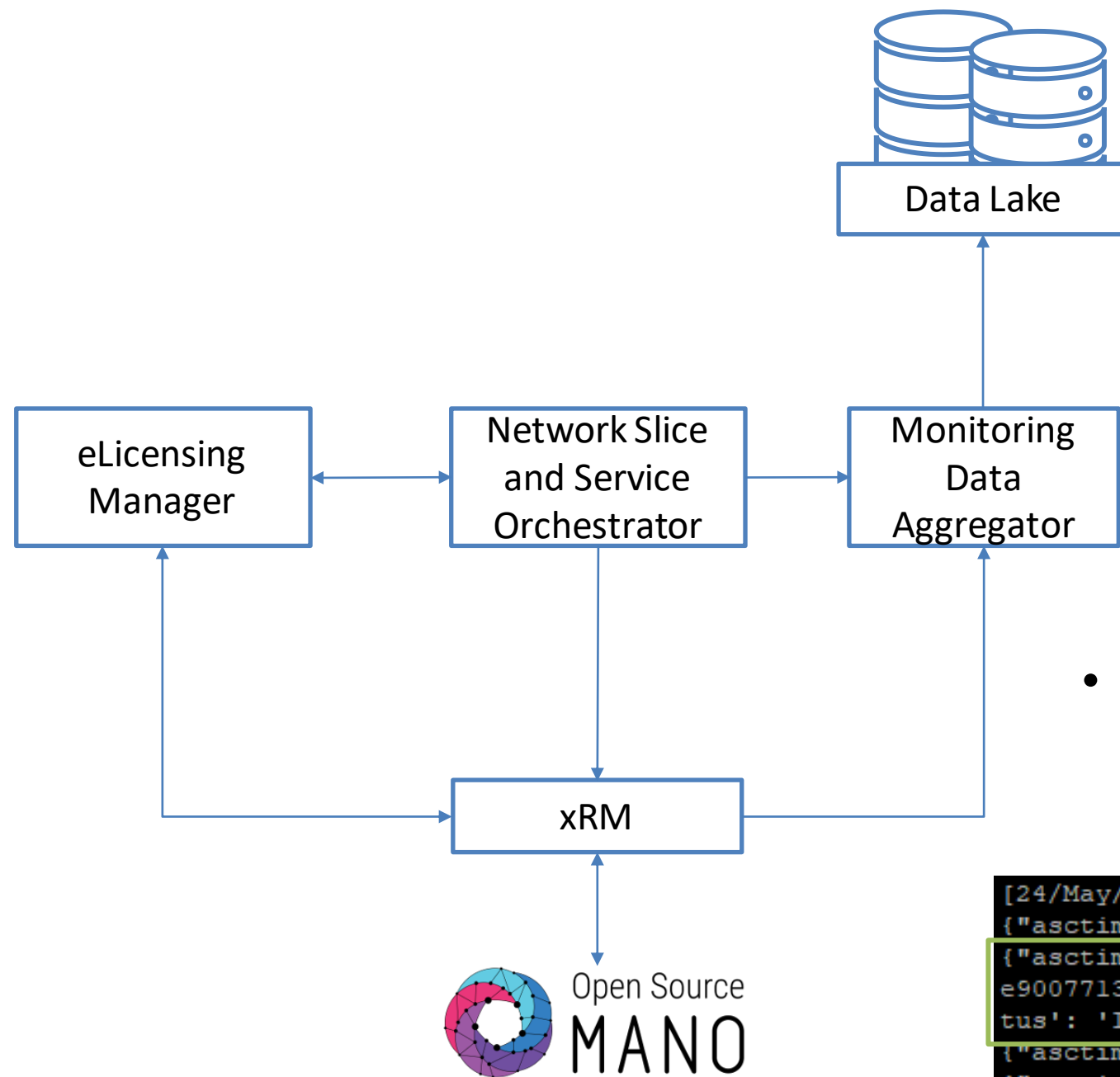
NS/VNF descriptors to TM Forum models and marketplace



- A **Resource Owner** can convert **ETSI OSM** descriptors directly from the **5GZORRO Web Portal**
 - **OSM 9/10 supported**
- **xRM** (Any Resource Manager) implements a dedicate translation logic
 - Created TM Forum objects **automatically stored** into the Resource and Service Offer Catalogue



eLicensing and Network Service/Slice Monitoring



- **Monitoring Data Aggregator** exploits **OSM metric collection capabilities** to periodically retrieve NS/VNF metrics to be stored into the **5GZORRO Datalake**

- **eLicensing Manager** deploys special **eLicensing Agents** that continuously monitor the licensing terms exploiting the OSM APIs
 - E.g., **TIME_OF_USE**

```
[24/May/2021 10:07:47] "POST /db/v1/watcher/1/manager/ HTTP/1.1" 200 15
{"asctime": "2021-05-24 10:07:47.446", "levelname": "DEBUG", "name": "views", "message": "FOUND Watcher time of use."}
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{"asctime": "2021-05-24 10:07:47.467", "levelname": "INFO", "name": "views", "message": "RUNNING"}
```


Conclusions & Next steps

5GZORRO offers a framework where network stakeholders can trade safely their resources and establish end-to-end cross domain services

- We rely on ETSI OSM for:
 - Creation of NFV-based products [[Catalogues](#)]
 - Network Slice Orchestration [[LCM](#)]
 - Service and Infrastructure monitoring [[MON](#)]
 - eLicensing [[NSR/VNFR](#)]

5GZORRO platform code on GitHub: <https://github.com/5GZORRO>

- Release **5gzorro-core-1.0-rc** in Dec-21
- Release **5gzorro-full-alpha** in Jun-22
- Release **5gzorro-full-1.0** by the end of the project (Oct-22)

Initial prototypes of 5GZORRO components delivered in the testing facilities of



and



Madrid

Validation in testbeds from Q1-22

Zero-touch security and trust for ubiquitous computing and connectivity in 5G networks

5G PPP Phase 3 project (ICT-20, 5G Long Term Evolution)

- Project Start: **Nov/2019**
- Duration: **36 months**

14 organisations from 7 different countries

- **Telcos:** Telefónica [ES] and Altice Lab [PT]
- **Regulator:** Malta Communication Authority [MT]
- **Large ICT Industries:** Intracom Telecom [GR], ATOS [ES], IBM [IL]
- **SMEs:** Nextworks [IT], Bartr Holdings Limited [UK], Ubiwhere [PT]
- **Research centres / universities:** I2CAT [ES], FBK [IT], Univ. Murcia [ES], Univ Carlos III Madrid [ES]
- **Communication specialist:** Comunicare Digitale [IT]



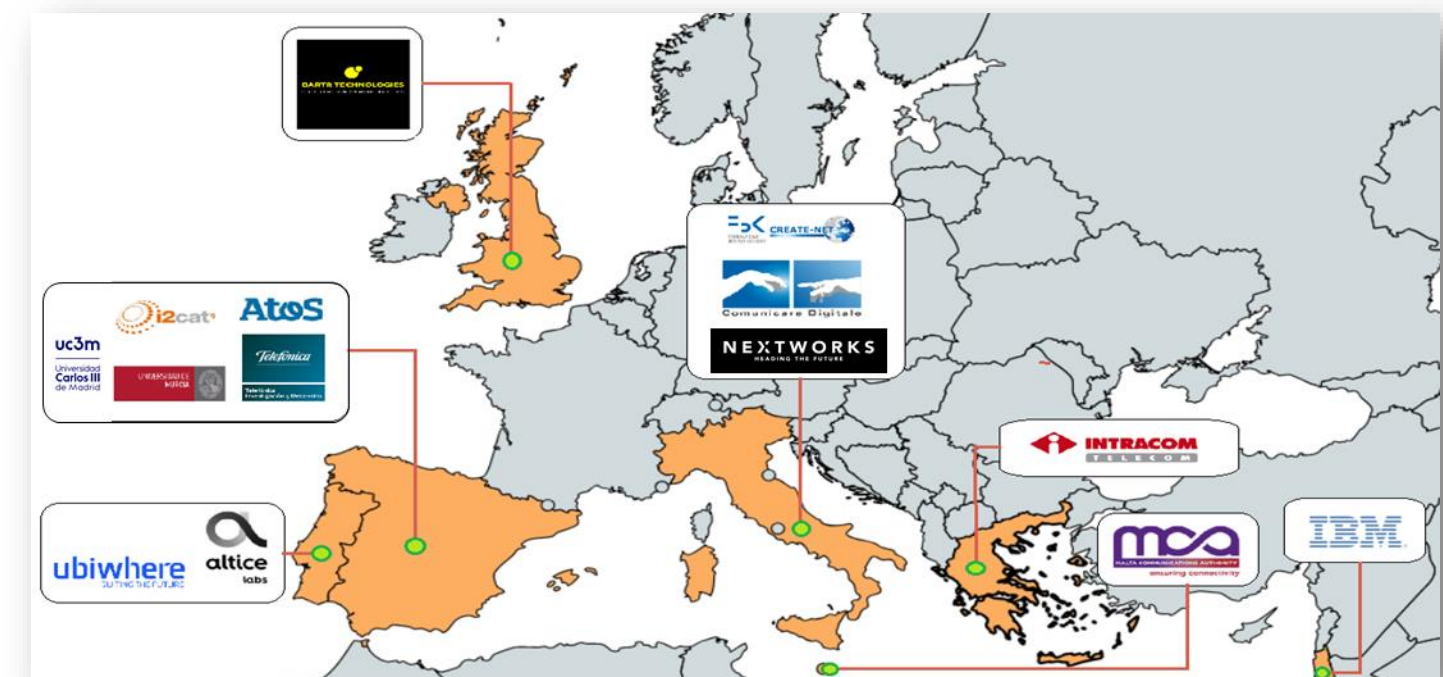
Project Coordinator



Technical Manager



Innovation Manager





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Thank You



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