



In partnership with gaia-X = Hub Spain









- Gaiamons are disseminated all around the venue and even in the plenary session slides
  - Catch them all to get a chance to...
    - Become the **best Gaiamon trainer**
    - And win a **Temporary Gaia-X Academy access** (sharable if you already have a full access)
- How? Each Gaiamon is linked to a QR Code.
  - Find the QR Codes
  - Scan them to be redirected to the Gaiamon Game
  - and validate to catch the Gaiamons
- You have collected all the Gaiamons already?
  - Wait for **the draw** at the end of the day
  - And discover who the winners will be!



One day I will be the best I will fight without respite...

gaia-x



gaia-x

First, **Get connected** to the Gaia-X Academy (and create an account if you don't already have one)



Stay aware: Wild Gaiamons will appear!

## Gaia-X Compliance: Loire 101

### 11:30 - 12:00

In partnership with gaia-X = Hub Spain



## Yassir Sellami, Software Engineer, Gaia-X



## I need a brave soul willing to be part of the presentation.

Who does have a pet?





## I want to train my AI to create a pet companion !

I need (a lot) of data, can I monitor your pet?





## How can I describe myself and be sure we understand each other ?

What does the word "salir" means to you?

### **Ontology 101**



- Improves communication and problem solving
- Acts as a single point of truth maintained by the community
- Ontologies are designed to be extended, reused and linked together
- Inference on knowledge graphs can extract new facts from existing knowledge
- Very appreciated in the artificial intelligence domain





- LinkML is a linked data modeling language
- Service Characteristics Working Group produces the LinkML ontology
- Gaia-X Lab Team contributes to LinkML
- It's based on YAML files



id: https://w3id.org/gaia-x/development#legal-person name: legal-person prefixes: gx: https://w3id.org/gaia-x/development# linkml: https://w3id.org/linkml/ vcard: http://www.w3.org/2006/vcard/ns# xsd: http://www.w3.org/2001/XMLSchema# https schema: https://schema.org/ imports: - linkml:types - address - participant default\_prefix: gx default range: string classes: LegalPerson: title: "Legal Person" is a: Participant description: A legal person, who is uniquely identified by its registration number. tree root: true attributes: registrationNumber: title: "registration number" required: true identifier: true multivalued: true inlined as list: true description: Country's registration number, which identifies one specific entity. Valid formats are local, EUID, EORI, any of: - range: LocalRegistrationNumber - range: VatID



Home

Slots

Enums

#### Classes

Interconnection Point Identifier

Classes

Interconnection Service Offering

Internet Exchange Point

Internet Service Provider

Issuer

- Jitter
- Latency
- LatestN

Legal Document

### Legal Person

Inheritance

Slots

Usages

Information

Schema Source

LinkML Source

Direct

Induced

### Legal Person

A legal person, who is uniquely identified by its registration number.

### URI: gx:LegalPerson





# How can I make sure who is claiming what, and that no one was able to change the content ?

Let's sign stuff now ! (In a digital world)

### Verifiable Credentials



- VCs are cryptographically signed by the issuer, allowing to check data tampering and issuer's legitimacy
- Used in Gaia-X to represent everything, companies, resources, services
- Represents any form of credential, permits, license



### **Verifiable Credentials**



```
"type": [
  "VerifiableCredential"
],
"id": "https://wizard.lab.gaia-x.eu/development/api/credentials/2d37wbGvQzbAQ84yRouh2m2vBKkN8s5AfH9Q75HZRCU",
"issuer": "did:web:wizard.lab.gaia-x.eu:development:api:credentials:2d37wbGvQzbAQ84yRouh2m2vBKkN8s5AfH9Q75",
"issuanceDate": "2024-10-24T18:57:30.460Z",
"credentialSubject": {
  "type": "gx:LegalParticipant",
  "gx:legalName": "Gaia-X European Association for Data and Cloud AISBL",
  "gx:legalRegistrationNumber": {
    "id": "https://gaia-x.eu/legalRegistrationNumberVC.json"
  },
  "gx:headquarterAddress": {
    "gx:countrySubdivisionCode": "BE-BRU"
  },
  "gx:legalAddress": {
    "gx:countrySubdivisionCode": "BE-BRU"
  },
  "id": "https://wizard.lab.gaia-x.eu/development/api/credentials/2d37wbGvQzbAQ84yRouh2m2vBKkN8s5AfH9Q75"
},
```



👬 J M T

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9. eyJzdWIiOiIxMjM0NTY30DkwIiwibmFtZSI6IkpvaG4 gRG9lIiwiaXNTb2NpYWwiOnRydWV9.

4pcPyMD09olPSyXnrXCjTwXyr4BsezdI1AVTmud2fU4

Source: jwt.io

### Json Web Token (JWT)

gaia-x



Source: logto.io/jwt-decoder



## How can I make sure to link my data and refer to any ontology ?

It's a graph !

### Json Linked Data (JSON-LD)

gaia-x

Que .

```
"@context":
 "https://www.w3.org/2018/credentials/v1",
  "https://w3id.org/security/suites/jws-2020/v1",
 "https://w3id.org/gaia-x/v1"
,
"type": [
  "VerifiableCredential"
"id": "https://wizard.lab.gaia-x.eu/development/api/credentials/2d37wbGvQzbAQ84yRouh2m2vBKkN8s5AfH9Q75HZRCU",
"issuer": "did:web:wizard.lab.gaia-x.eu:development:api:credentials:2d37wbGvQzbAQ84yRouh2m2vBKkN8s5AfH9Q75",
"issuanceDate": "2024-10-24T18:57:30.460Z",
"credentialSubject": {
 "type": "gx:LegalParticipant",
 "gx:legalName": "Gaia-X European Association for Data and Cloud AISBL",
 "gx:legalRegistrationNumber": {
    "id": "https://gaia-x.eu/legalRegistrationNumberVC.json"
  },
  "gx:headquarterAddress": {
    "gx:countrySubdivisionCode": "BE-BRU"
  },
  "gx:legalAddress": {
    "gx:countrySubdivisionCode": "BE-BRU"
 },
  "id": "https://wizard.lab.gaia-x.eu/development/api/credentials/2d37wbGvQzbAQ84yRouh2m2vBKkN8s5AfH9Q75"
```

### Json Linked Data (JSON-LD)



### Json Linked Data (JSON-LD)



<sub>⊮</sub> <sup>"</sup> Expanded	,⊮ Compacted	≡ Flattened	t Framed	🔩 N-Quads	Canonized	III Table	Visualized	J Signatures	
<pre>{     Capanded     {         "@id": "htt         "@type": "h         "https://ww         "@id": "h         "@type":         "https://         "logid":         }     },     "https://ww         "@id":         }     },     "https://ww         "@id":         }     },     "https://ww         "@id":         }     },     "https://ww         "@id":         // "@idue":         // "@idue"</pre>	<pre>ps://wizard.lab ttps://www.w3.o w.w3.org/2018/c ttps://wizard.l "https://wizard.l "https://w3id.o w3id.org/gaia-x //w3id.org/gaia-x w3id.org/gaia-x w3id.org/gaia-x w3id.org/gaia-x w3id.org/gaia-x w1ttps://gaia-x</pre>	<pre>.gaia-x.eu/de rg/2018/crede redentials#cr ab.gaia-x.eu/ rg/gaia-x/dev /development# -x/development# /development# /development# .eu/legalRegi redentials#is org/2001/XMLS :57:30.4607"</pre>	velopment/ap ntials#Verif edentialSubj development/ elopment#Leg headquarterA t#countrySub legalAddress t#countrySub legalName": legalRegistr strationNumb suanceDate":	<pre>i/credentials iableCredentials ect": { api/credentia alParticipant ddress": { divisionCode" ": { divisionCode" "Gaia-X Europ ationNumber": erVC.json" { me",</pre>	<pre>/2d37wbGvQzbAQ8 al", ls/2d37wbGvQzbAQ8 ", : "BE-BRU" : "BE-BRU" ean Association {</pre>	a for Data	<pre>BK", ", and Cloud AISB</pre>	July Signatures	
},									 •



## How can really verify the claims of this "VC" without depending on a central entity ?

We are going **de**centralized.

### **Decentralized Identifiers**

- Self-declaration / Self-hosted
- Contains the public key and the certificate used for verification
- Currently used method: did:web



### **Decentralized Identifiers**

```
"@context": [
  "https://www.w3.org/ns/did/v1",
 "https://w3id.org/security/suites/jws-2020/v1"
"id": "did:web:gaia-x.eu",
"verificationMethod": [
   "id": "did:web:gaia-x.eu#key-0",
    "type": "JsonWebKey2020",
   "controller": "did:web:gaia-x.eu",
    "publicKeyJwk": {
     "kty": "EC",
     "alg": "ES256",
     "kid": "7de84069-37b4-b963-7b4b-a2ec3f833b14",
     "crv": "P-256",
     "x": "8Z0jEI9aU-LtW8ShisfoJIyY-4yS0XufP-60mXzqahQ",
     "y": "WOMQ0gecOzGFNKaPUIgBHsa0sp0MBQ4UFyzs40zGL24",
     "x5u": "https://gaia-x.eu/.well-known/x509Certificate.pem"
"assertionMethod": [
  "did:web:gaia-x.eu#key-0"
```



## But anyone can create a keypair and certificate ?

Trust issues.

### x.509 Certificate

- Establishing Trust: X.509 certificates are used to ensure the authenticity and security by creating a chain of trust between an entity and a Certificate Authority (CA).
- Role of the Certificate Authority (CA): A CA issues the X.509 certificate after verifying the identity of the requesting entity, thereby ensuring that the digital identity is trustworthy.
- Encryption and Digital Signature: The certificate contains a public key associated with a digital signature issued by the CA, allowing secure exchanges and verifying that the data has not been altered.
- Certificate Chain: Trust in an X.509 certificate relies on a hierarchy of certificates, where a root certificate is at the base, ensuring the validity of intermediate and "leaf" certificates.



### x.509 Certificate

gaia-x

Common Name: lab.gaia-x.eu

Subject Alternative Names: lab.gaia-x.eu

Organization: Gaia-X Lab

Organization Unit: Gaia-X European Association For Data And Cloud AISBL

Locality: Brussels

State: Brussels

Country: BE

Valid From: April 16, 2024

Valid To: April 14, 2034

Issuer: lab.gaia-x.eu, Gaia-X Lab

Key Size: 4096 bit

Serial Number: 26d3614cdc8c12723db380f0ee80e67ac36a9f10

### **Gaia-X Trust Anchors**

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- The Trust Anchors defines the parties accepted by Gaia-X to signed specific attestations.
- A Trust Anchor has always a specific scope. -
- The list of Trust Anchors and their scopes are store in the Gaia-X Registry



Party: legal person, natural person, workload



## What if I want to set very specific and strict rules to my service ?

You shall not pass !

### **ODRL (Open Digital Rights Language)**

```
"@context": [
    "http://www.w3.org/ns/odrl.jsonld"
],
"@type": "Offer",
"uid": "http://example.com/policy/123",
"permission": [
    {
        "@type": "Permission",
        "target": "http://example.com/asset/456",
        "action": "http://example.com/asset/456",
        "assigner": "http://example.com/provider"
}
```



~ / / / / /

///////

### **ODRL (Open Digital Rights Language)**



```
"@context": [
  "http://www.w3.org/ns/odrl.jsonld",
  { "gx" :"https://w3id.org/gaia-x/development#" },
  { "ovc": "https://w3id.org/gaia-x/ovc/1/" }
,
"@type": "Offer",
"uid": "http://example.com/policy/123",
"profile": "https://w3id.org/gaia-x/ovc/1/",
"permission": [
    "@type": "Permission",
    "target": "Your beautiful pet",
    "action": "Monitor",
    "assigner": "Pet owner",
    "ovc:constraint": [
        "ovc:leftOperand": "$.credentialSubject.gx:legalAddress.gx:legalName",
        "operator": "eq",
        "rightOperand": "Gaia-X European Association for Data and Cloud AISBL",
        "ovc:credentialSubjectType": "gx:LegalPerson"
1,
"prohibition": [
    "@type": "Prohibition",
    "target": "Pet's home",
    "action": "Spy",
    "assigner": "Pet owner"
```





## Where does Gaia-X come in?

Compliant, you must be.





- Known as shapes in our ecosystem, and written in Turtle
- Not all constraints can be expressed in SHACL, some business rules need code to be implemented
- Similar to XSD for XML

Name	Cardinality and Range	Description	Inheritance
registrationNumber	1* RegistrationNumber	Country's registration number, which identifies one specific entity	direct
legalAddress	1 Address	The full legal address of the organization	direct
headquartersAddress	1 Address	Full physical location of the headquarter of the organization	direct
parentOrganizationOf	* LegalPerson	A list of resolvable links to Gaia-X Credentials of participants that this en	direct
subOrganisationOf	* LegalPerson	A list of resolvable links to Gaia-X Credentials of participants with a legal	direct
name	01 xsd:string	A human readable name of the entity	GaiaXEntity
description	01 xsd:string		GaiaXEntity

```
gx:LegalPersonShape a sh:NodeShape ;
                                                                                                                                                                                 × × × × ×
    sh:closed true ;
                                                                                                                                                                                 × × × / /
    sh:description "A legal person, who is uniquely identified by its registration number." :
                                                                                                                                                                                 · / / \ \ \
    sh:ignoredProperties ( rdf:type ) ;
                                                                                                                                                                                /////N
                                                                                                                                                                     aaia-x
    sh:name "Legal Person";
    sh:property [ sh:class gx:RegistrationNumber ;
            sh:description "Country's registration number, which identifies one specific entity. Valid formats are local, EUID, EORI, vatID, leiCode.";
            sh:minCount 1 ;
            sh:name "Registration Number";
            sh:nodeKind sh:BlankNodeOrIRI ;
            sh:order 0 ;
            sh:path gx:registrationNumber ],
        [ sh:class gx:Address ;
            sh:description "The full legal address of the organization.";
            sh:maxCount 1 ;
            sh:minCount 1 ;
            sh:name "legal address" ;
            sh:nodeKind sh:BlankNodeOrIRI ;
            sh:order 1 ;
            sh:path gx:legalAddress ],
          sh:datatype xsd:string ;
            sh:description "A human readable name of the entity.";
            sh:maxCount 1 ;
            sh:name "name";
            sh:nodeKind sh:Literal ;
            sh:order 5 ;
            sh:path schema:name ],
        [ sh:class gx:LegalPerson ;
            sh:description "A list of resolvable links to Gaia-X Credentials of participants that this entity is a subOrganization of, if any.";
            sh:nodeKind sh:BlankNodeOrIRI ;
            sh:order 3 ;
            sh:path gx:parentOrganizationOf ],
          sh:datatype xsd:string ;
            sh:maxCount 1 ;
            sh:nodeKind sh:Literal ;
            sh:order 6 ;
            sh:path schema:description ],
          sh:class gx:LegalPerson ;
            sh:description "A list of resolvable links to Gaia-X Credentials of participants with a legal mandate on this entity, e.g., as a subsidiary."
            sh:nodeKind sh:BlankNodeOrIRI ;
            sh:order 4 ;
            sh:path gx:subOrganisationOf ],
        [ sh:class gx:Address ;
            sh:description "Full physical location of the headquarter of the organization.";
            sh:maxCount 1 ;
            sh:minCount 1 :
                                                                                                                                                                                 SHACL Shapes
             The second se
```

### **Compliance Document => Code**

gaia-x

**Criterion P1.1.2**: The Provider shall have an option for each legally binding act to be governed by EU/EEA/Member State law.

Standard Compliance	Label Level 1	Label Level 2	Label Level 3
declaration	declaration	declaration	declaration

**Declaration**: Using the Gaia-X Ontology, the declaration shall contain the list of ISO 3166-2 codes indicating the EU/EEA/Member States whose law may be applied as governing law for the legally binding act.

#### Permissible Standards:

- SecNumCloud: 19.1.c
- CISPE (GDPR, Infrastructure & laaS): 4.2
- EU Cloud CoC (GDPR, XaaS): 5.1.A, 5.1.B, 5.1.C, 5.1.F, 5.4.F

### Example Standards:

- BSI C5: BC-01
- CSA CCM: STA-09
- SWIPO laaS: FR1, FR2

### **Compliance Document => Code**

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Standard Compliance	Label L1	Label L2	Label L3	
declaration	declaration	declaration	declaration	
implemented	implemented	implemented	implemented	

#### View in Compliance Document

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### Example Standards:

- BSI C5: BC-01
- CSA CCM: STA-09
- SWIPO laaS: FR1, FR2

Checks that the ServiceOffering has at least one LegallyBindingAct in its legalDocuments that is governed by an EAA country referenced in its governingLawCountries.

Implemented by ServiceOfferingLegallyBindingActsHaveGoverningLawCountry

### **Compliance Document => Code**

gaia-x

**Criterion P1.1.2**: The Provider shall have an option for each legally binding act to be governed by EU/EEA/Member State law.

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The Provider shall have an option for each legally binding act to be governed by EU/EEA/Member State law.

Standard Compliance	Label L1	Label L2	Label L3	
declaration	declaration	declaration	declaration	
implemented	implemented	implemented	implemented	

#### View in Compliance Document

Checks that the ServiceOffering has at least one LegallyBindingAct in its legal nts that is governed by an EAA country referenced in its governingLawCountries. Implemented by ServiceOfferingLegallyBindingActsHaveGoverningLawCountry verifyLegalDocuments(vpUUID: string, contextVersion: string, results: ServiceOfferingLegalDocuments[]): FilterValidationResult { this.logger.debug(`Checking that service offerings have legally binding acts that can be governed by EEA for VPUUID \${vpUUID}...`) const errorMessages: string[] = [] let isP115Valid = true let isP112Valid = true for (const result of results) { const legallyBindingActs: LegalDocument[] = result.legalDocuments.filter( legalDocument => legalDocument.type === `w3id.org/gaia-x/\${contextVersion}#LegallyBindingAct` ) for (const legallyBindingAct of legallyBindingActs) { if (!legallyBindingAct.governingLawCountries.length) { this.logger.error( `P1.1.5 - Service offering \${result.serviceOfferingId} does not have a governing law country for legally binding act \${legallyBi errorMessages.push( `P1.1.5 - Service offering \${result.serviceOfferingId} does not have a governing law country for legally binding act \${legallyBi isP115Valid = false } else if (!legallyBindingAct.governingLawCountries.some(governingLawCountry => EEA\_COUNTRY\_NAME\_ALPHA2.includes(governingLawCountry this.logger.error( `P1.1.2 - Service offering \${result.serviceOfferingId} with legally binding act \${legallyBindingAct.url} must have at least one ) errorMessages.push(



## Great, where do I start?

Los Tres Amigos.
#### **Based on standards**



	GXDCH Services** (Mandatory / Optional)	Technical stack	
TAGUS v1 (22.10)	<b>Registry service</b> (Ontology, Trust Anchors, Terms&Conditions)	JSON-LD, RDF, W3C SHACL, Trust Anchors	
	<b>Compliance</b> & <b>Notary services</b> (incl. Gaia-X Conformity & Gaia-X Label)	W3C SHACL engine, Trusted Data Sources, W3C VC	
	Wallet & Wizard	WebAuthn, WebCrypto, Presentation Exchange, OIDC	

LOIRE v2 (24.11)	Compliance*	VC-JWT, VC Data Model 2, SHACL	
	Legal Registration Number Notary*	VC-JWT, VC Data Model 2	
	Registry service*	w3id.org/gaia-x , Linkml, x509	
	IPFS Pining Service	ETSI TS 119 612, Trust Anchors, Ontology	
	Credential Event Service	Cloud Events	



# How to make sure that these components are always available, not handled by one provider or in one location ?

Always there for you.

# Gaia-X Digital Clearing House (GXDCH)

Aire Networks ⑦	Arsys 📀	Aruba ⊘	T-Systems 🔗	DeltaDAO 📀	OVHCloud (?)
VERSION STATUS COMPLIANCE	VERSION STATUS COMPLIANCE				
1.14.0 UP	1.14.0 UP				
REGISTRY 1.10.4 UP	REGISTRY 1.10.3 UP				
NOTARY 1.7.0 UP	NOTARY 1.8.0 UP	NOTARY 1.7.0 UP	NOTARY 1.8.0 UP	NOTARY 1.8.0 UP	NOTARY 1.7.0 UP
VERSION STATUS	VERSION STATUS				
2.7.2 UP	2.7.2 UP		2.7.2 UP	2.7.2 UP	
REGISTRY	REGISTRY	REGISTRY	REGISTRY	REGISTRY	REGISTRY
NOTARY	NOTARY	NOTARY	NOTARY	NOTARY	NOTARY
2.9.0 UP	2.9.0 UP		2.9.0 UP	2.9.0 UP	
Neusta Aerospace 🛇	Proximus 📀	Pfalzkom 🔗	CISPE ⑦		
VERSION STATUS COMPLIANCE	VERSION STATUS COMPLIANCE	VERSION STATUS COMPLIANCE	VERSION STATUS		
1.14.0 UP	1.14.0 UP	1.14.0 UP	1.14.0 UP		
REGISTRY 1.10.4 UP	REGISTRY 1.10.3 UP	REGISTRY 1.10.4 UP	REGISTRY 1.10.4 UP		
NOTARY	NOTARY	NOTARY	NOTARY		
1.8.0 UP	1.7.0 UP	1.8.0 UP	1.8.0 UP		
VERSION STATUS COMPLIANCE	VERSION STATUS COMPLIANCE	VERSION STATUS COMPLIANCE	VERSION STATUS COMPLIANCE	E E E E E E E E E E E E E E E E E E E	<u>ц</u>
2.7.2 UP	REGISTRY	2.7.2 UP	2.7.2 UP	СХРСН	
2.8.1 UP		201	201	GADON	
2.8.1 UP		2.8.1 UP	2.8.1 0P		

gala-x



# Why not try it yourself.

Gaia-X Compliance Technical Workshop



tinyurl.com/gaia-x-workshop



# Thank you!

#### Yassir SELLAMI | yassir.sellami@gaia-x.eu

In partnership with GOIO-X Hub Spain

ICT TECHNOLOGY CENTER

# An Integrated Open-Source SaaS Solution for Implementing Data Spaces • M

#### 12:00 - 12:20

In partnership with gaia-x = Hub Spain



Manuel Escuin, Cloud and Orchestrator Leader, Aire Networks

gaia-x

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## Towards a next generation cloud for Europe (15-10-2020) Overall mission drives the Gaia-X Architecture.

- Gaia-X aims to create a federated open data infrastructure based on European values regarding data and cloud sovereignty.
- The mission of Gaia-X is to design and implement a data sharing architecture that consists of common standards for data sharing, best practices, tools, and governance mechanisms.
- It also constitutes an EU-anchored federation of cloud infrastructure and data services, to which all 27 EU member states have committed themselves.





# Gaia-X Architecture (July 2022)





### **Gaia-X Ecosystem**

An ecosystem on Gaia-X is the virtual set of Participants, Resources, and Service Offerings that meet the requirements specified in the Gaia-X Trust Framework

#### Participants.

- Natural Persons or Legal Persons (Organizations))
- Rol: Provider, Consumer, or Federator

#### Service Offerings:

- Composed of Resources (physical or virtual)
- Served by Participants

#### **GXCH Clearing House**









# **High-level overview of GAIA-X relations**







# **Gaia-X Clearing House. Processes & Labeling**







# High-level overview of GAIA-X architecture vs tools



- Airenetworks' proposal is divided into two main tools:
  - The DataSpace Platform
    - Control data governance, policies, and usage features
    - Ensures compliance with Gaia standards, especially those related to GXCH
  - The orchestratorHDISM
    - Manage the functions related to the comprehensive management of the physical architecture of the systems that support the dataspace
    - Services related to identification and trust in accordance with the GXCH
    - The catalogue of services, in a holistic vision of them
- Our reference model is mainly based on the architecture proposed by Gaia-X and the IDSA (International Data Spaces Association) standards, the IDS architecture and the formal IDS DIN SPEC 27070 standard.





# Aire Data Space Simplifying Data Space Management

The platform comes in three distinct packages, tailored to key ecosystem roles:







# Aire Data Space Platform Integrated and Automated Deployment

Aire Data Space uses a comprehensive set of advanced OpenSources technologies to deliver a robust and scalable solution within Gaia-X ecosystem.

- The current version is integrated with the functionalities of the Tagus Version of the GXCH
- Next release will be integrated with the Loire.





### What does your Data Space need? Expert integrators and a data infrastructure

#### Data Integration Service (\*)

Data preparation and transformation: Data is adapted and organized for use in the data space.

**ETL Automation:** Automatic processes to efficiently extract, transform, and load data.

**Standardization and enrichment:** Ensure the quality and usefulness of data before publishing it as assets.

**Data compatibility:** It allows you to integrate data from different sources and formats.

#### **Data Lake Infrastructure and Tools**

Public or Private cloud deployment: We can use the same technology in both implementations

**Data Lake y Data Mart:** Allows you to organize and structure data for quick analysis and access.

**Monitoring and Alerting:** It provides notifications and facilitates quick troubleshooting in data processes.

**Dedicated infrastructure:** Support to handle intensive processes and large volumes of data, ensuring scalability and efficiency.

\* Through specialized partners





### What does your data space need?

Infrastructure and tools

#### **Federation Service Provider Solution Enterprise**

The Federation Service Provider Solution is the key component that manages the participants and the Marketplace in the data space.

Functionalities included:

- Fully Infrastructure and Services orchestration. Holistic Integration of assets from the management
- Deploy on a virtual machine (VM) for easy system management and scalability.
- Clearing House Integration: Validation and compliance of data transactions.
- Identity Manager: Centralized identity management and secure authentication.
- Federated Catalog as part of GXCH: Allows you to explore data assets in the Gaia-X ecosystem.
- Automation tools: Automated configuration, updating and management of the environment.
- Licensing and technical support: Includes bug resolution with an adaptable SLA according to the environment.





### What does your data space need?

Infrastructure and tools

#### **Provider Participant Solution Enterprise**

For each data provider in your data space, you'll need a Provider Participant Solution. Each includes:

- Deploy to a virtual machine (VM) for easy system management and scalability.
- Licensing and technical support: Includes bug resolution with an adaptable SLA according to the environment.
- Additional functionalities to the standard EDC (as part of the orchestration model):
  - Advanced data asset management: Create, view, and manage assets with greater flexibility.
  - Integrated catalog for exploring data assets in federated catalogs.
  - Specific management of contracts and supplier data use policies.
  - Real-time monitoring of data space resources (CPU, GPU, Memory, Storage).
  - Gaia-X 24.11 support and participant identity management.
  - Additional data visualization and analysis tools, including custom dashboards and support for advanced charts with Chart.js.
  - Automation tools: Automated configuration, updating and management of the environment.



### What does your data space need? Data Space Experts

#### **Space Management Service**

- Custom connectors for source and destination systems.
- Automation of data flows.
- Real-time monitoring of data transfers.
- Integration of assets (data and services) and compatibility with Gaia-X standards.
- Administration of the Federation Service Provider and Provider Participants.
- Configuring and maintaining federated catalogs.
- Continuous monitoring of data space performance.
- Optimization of infrastructure and scalability of solutions.

#### **Governance and legality Service**

- Advice on data use policies and smart contracts.
- Verifiable credential management. Audit for compliance with eIDAS and data regulations (GDPR, Gaia-X).
- Implementation of identity management tools and certifications.
- Support in the management of the Clearing House for secure transactions







# **Definition of the Supra Orchestrator HDISM**

- The Supraorchestrator is an HDISM (Hybrid Digital Infrastructure & Services Management) application developed from holistic orchestration models, which allows the integral management of the complete Stack of necessary technologies, from generation to services, through the different layers, DCIM, Computing, Storage, Network and Security, which will be fully implemented as defined by the software.
- The federated management is carried out from the HDISM tool, taking into account especially the variables of energy efficiency and security of user data. To do this, it will use Artificial Intelligence (AI) tools based on learning models. It is built on four pillars:
  - Federated trust identity, based in GXCH
  - Cloud Intelligence
  - InterCloud workload distribution
  - High-capacity redundant communication network





# **HDISM SupraOrchestrator Architecture**









# UPCxels – A User Centric Data Space

#### 12:20 - 12:35

In partnership with gaia-X = Hub Spain



# Aniket Satbhai, Service Engineer, UPCxels

gaia-x



Project funded by the Secretary of State for Digitalization and Artificial Intelligence and the European Union.



# UPCxels

Agri-food data space complemented with multi-sector data and Al-based data analytics services

#### 12:20 PM, 13th May 2025





Albert Cabellos



Aniket Satbhai Service Engineer



Jordi Paillissé



Mikaela Colet



Project funded by the Secretary of State for Digitalization and Artificial Intelligence and the European Union.



Agricultural information standard oriented to Artificial Intelligence based services for agri-food use cases.





#GaiaX #MarketX25 #TechX25

**Cecilio Angulo** cecilio.angulo@upc.edu

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Anna Gras anna.gras@upc.edu



Carla Lázaro carla.lazaro@upc.edu





# Who is participating in Agrixels?

Financiado por la Unión Europea

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DE CATALUNYA BARCELONATECH

Agrixels promotes the **public-private collaboration**, involving administrations, companies, clusters, technology centers, agricultural cooperatives and central markets, ensuring broad representation and sustainability of the project.



# Challenge: more data than ever... but are we taking advantage of it?

**Every sector is constantly generating data** through sensors, satellites, administrative records, meteorological data, etc.

However, these data are **dispersed and not connected**, which limits their usefulness for decision making.

Each company, entity or administration has **its own data management system**.







UPCxels facilitates secure and efficient data exchange between companies, public administrations and research groups



#### Multi-sector platform

Create a **infrastructure** to integrate data and services from multiple sectors, with an initial focus on the agri-food and mobility sectors.

Develop **AI-based services** and share data between companies.

Validate models in a demonstrator center.



#### Advanced governance

Use **digital contracts** with legal validity for **to ensure traceability**, **sovereignty and security of data**.

3

#### Services Marketplace

Provide a **digital marketplace** for data and technology services, including **AI models**, with the ability to **monetize data and services.** 



#### Interoperability

Integrate recognized systems and standards such as **Gaia-X, Eclipse and IDSA**, allowing connection with other European Data Spaces.



#### **Project scalability**

Ensure a solid entrepreneurial ecosystem with a viable business model.

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Promote **open dissemination** and cooperation on **data monetization**.



# 2.1 Architecture: designed based on business needs

We listen to companies

#### We analyze:

- Technological capabilities
- Limitations
- Needs

We design a flexible architecture: UPCxels evolves to offer customized solutions

2



# **Software Architecture**

- Connector Eclipse Data Space
- Datalake Apache Hudi
- Credentials: Gaia-X and DID:WEB

#### Limitations:

- Lack of technological capacity to run a connector on their infrastructure.
- Lack of interest: they do not want to take on this management.
- A copy of the data ends up at the consumer.





# Software Architecture: Connectoras-a-service

- The data and the EDC connector reside in the UPCxels infrastructure.
- Each company will have its own replicated infrastructure.
- Developing a 'web wrapper' for the connector, which will allow companies to:
  - -Configure access policies.
  - Consult activity logs.
  - -Upload data.
  - Delete data or uninstall the connector.
- This is NOT the ideal mode.



Producer and consumer operate within the data space



# Software Architecture: Where are the algorithms executed?



The algorithm is validated by UPCxels.



# 2.2 Infrastructure

Physical hosting: **Datacenter UPC** ISO 9001 and ISO/IEC 27001:2013 certified.

Open-source community software:

Eclipse, Gaia-X

All software used in the data space will be **open-source and public.** 







# 2.3. Interoperability



# What type of interoperability do we consider?

- Framework defined by GAIA-X
- We will generate Verifiable Credentials
- Standard Data Models
  - ED Data Model specified in the project DEMETER
- We use the Eclipse catalog
- We use the Eclipse Data Space Connector
- Identity based on Distributed Identity DID using the **DID:WEB method.** 
  - Management of decentralized web identifiers
- As a trust framework we will use W3C Verifiable Credentials
  - Compatible with GAIA-X



# What security and transparency do we provide to companies with

UPCxels guarantees an environment where all actions and agreements are recorded, ensuring traceability, privacy and authorized access.



**Digital contracts** formalize data sharing.



Legal registry documents information management



Advanced encryption protects data from unauthorized access.



**External validation** (Gaia-X Clearinghouse)

#### **EVENT REGISTRATION**

User: Company A

FIELD-1 data has been **shared** with company B on date DD/MM/YYYY

Company B has **accessed** to the data on DD/MM/YYYY HH:MM

You have **expired** the permission to company B for FIELD-1 data.

FIELD-1 data has been **deleted** from the platform on DD/MM/YYYY date


#### 4. UPCxels Governance Framework

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#### What is it?

- ✓ Management and coordination model of the UPCxels data space.
- ✓ It guarantees a secure, ethical and efficient **exchange** of data between organizations.

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Clear rules	Access, use and traceability of data
Participation agreements	Definition of roles, responsibilities and rights of participants
Based on international and European European standards	IDSA Rulebook, Gaia-X guidelines, DSSC and Data Office
Regulatory compliance	RGPD, Data Act, Data Governance Act
Data sovereignty	Core Principle
Data policies	Regulation of who has access and under what conditions
Governance Committee	Neutral and independent and without commercial interests





**Data catalog** public / private

Catalog of Al algorithms

#### Indicated:

- Access conditions
- Location data (Demonstrator, Company, Public Administration)

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DE CATALUNYA

Participante Statistica Construction España I digital

Contact person



# 6. What impact does it have on companies, administrations and research?

Private companies	Increased efficiency and profitability thank to access to strategic data.	
Public administrations	Updated data for <b>to design evidence-based policies</b> , optimizing management and promoting sustainable models.	
Research and innovation	<b>Promoting new technologies</b> , predictive models and optimization tools.	

#### Data sharing opportunities

- More accurate and agile decision making.
- Reduction of uncertainty and greater response capacity.
- Creation of new business models and emerging markets.
- Promotion of the circular economy and the commercialization of data.
- A more competitive and innovative ecosystem.



Agrixels establishes a common agricultural data format based on **geolocation and temporality**, to improve interoperability and data usage in the sector.

**Structures and standardizes** dispersed data, facilitating its analysis with AI

**Integrates multiple sources**, unifying information from companies, administrations and citizen science.

Scalable and adaptable, incorporating new challenges, actors and technologies.





# What is the Agrixel standard?

It is an interoperable **geospatial data format** for the agri-food sector.

**Based on IA** and the standards of **OGC**, it allows to structure and share information efficiently. Works like **pixels in computer vision**, where each geospatial unit represents a specific area, facilitating analysis and decision making.

#### **KEY FEATURES**

- FAIR Format: Data Findable, Accessible, Interoperable, Reusable, Interoperable
- Compatible with ArcGIS and existing geospatial solutions
- Flexible and scalable framework, allowing integration with multiple sectors





**Agríxel** is an ontology *domain-specific*, like *agriCrop* or *agriPest*, based on the AIM model.

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It complies with:

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- the standards W3C and IDSA for the definition of *Metadata*
- semantic interoperability (*agri-semantic*) mainly using *AGROVOC* and *Saref4Agri*
- the approach *cross-domain*, e.g. with *OGC* for satellite data.
- The specific pilots focused **on** Sustainability and Carbon footprint



#### Thank you!

Contact us at: upcxels.ideai@upc.edu

In partnership with GOIO-X T Hub Spain

ICT TECHNOLOGY CENTER

#### Expanding the Gaia-X Trust Framework to the World

#### 12:35 - 12:50

In partnership with **gaia-X** Hub Spain



José Andrés Muñoz Arcentales, Assistant Professor Doctor, Polytechnic University of Madrid

gaia-x

 Andrés Muñoz-Arcentales Assistant professor @ UPM







UNIVERSIDAD POLITÉCNICA DE MADRID

# EUNOMIA Eúvoµia

# Expanding the Gaia-X Trust framework to the world



Financiado por la Unión Europea NextGenerationEU



MINISTERIO PARA LA TRANSFORMACIÓN DIGITAL Y DE LA FUNCIÓN PÚBLICA



SECRETARÍA DE ESTADO DE DIGITALIZACIÓN

E INTELIGENCIA ARTIFICIAL

Plan de Recuperación, Transformación y Resiliencia



INSTITUTO NACIONAL DE CIBERSEGURIDAD

















#### Joaquín Salvachúa

UPM professor that has been involved into formal method for specification and verification of protocols. Multimedia and real time protocols (coauthor of an RFC). Teaching over Cloud infrastructure, Big data infrastructure and Blockchain and DLT technologies.



#### Andrés Muñoz-Arcentales

Assistant Professor at UPM and a Senior Researcher in the Next Generation Internet Research Group (GING/UPM) with main research interests in the fields of Smart Spaces, Data Fusion, Data Spaces, Machine Learning, Digital Twins, Cloud and Edge Computing and Big Data infrastructure.



#### Rodrigo Menéndez Muñoz

Researcher at the Next Generation Internet Group (GING/UPM) and Master's student in Telecommunications Engineering at Universidad Politécnica de Madrid (UPM)











#### GING - UPM

We all belong to here: <u>https://ging.github.io/</u> Research group GING at the Polytechnic University of Madrid.

Our research focuses mainly on protocols and WWW standards and technologies applied to numerous use cases. Currently, we are **focused on research in cloud computing**, education, learning analytics, **data engineering**, distributed videoconferencing systems with WWW standards, **LLMs and AI**, **open data**, **and data spaces**.

Participation into **several standardization committee**. Participation into IETF, W3C, ETSI and other standardization bodies.











#### What is Eunomia?

Eunomia (Euvoµia ' good law ') was the goddess of laws and legislation.

It was associated with the internal stability of a state, including the enactment of good laws and the maintenance of civil order. She was also the spring goddess of green pastures (nomia in Greek). Eunomia was one of the Horai (Horae), goddesses of the seasons and guardians of the gates of heaven. Her sisters were the goddesses Dike (Justice) and Eirene (Peace). Its opposite was Dysnomia (Anarchy).











#### **Our Mission**

We work on **various levels**, attempting to **fill some gaps** within data space architectures and **predict some future lines**, some of them like the following:

- Evolution of transport protocols
- Covering data governance and **distributed data governance requirements**
- Addressing trust anchor systems beyond European borders
- Use of self-sovereign identity, **SSI**
- Application of **ODRL**, Zero Trust, and **ReBAC** for policy management
- Metadata for data spaces
- Use of **DataLakehouse** architectures applied to data spaces
- High-speed transmission systems

#### #Galax #WarketX25 #lechX25

Project supported by INCIBE

EUNOMIA-Soluciones para la soberanía, confianza y seguridad en los espacios de datos

*C.128.23 EUNOMIA, C130.23 MCIPYME* 











#### Contents

What are we going to speak about today:

We will mainly define some research lines we're follow, define requirements, draw some conclusions, possible drawbacks and future plots.

- Gaia X Trust framework current specifications. What's missing?
- Different flows as solutions



# Trust framework goes... intergalactical 😳









#### Self Sovereign Identity (SSI)

The basic SSI framework is based on a simple idea.

Identity management is in the hands of the identity holder. Whenever a holder needs to identify himself, he presents a series of claims to the verifier, or relying party.

The relying party, to verify the claims, must know if the issuer exists, if the issuer is who he claims to be, and if the claims issued by the issuer are correct.











Wallet -



Trust framework goes...

#### SSI architecture

To achieve this, several mechanisms are used, such as DIDs, cryptographic proofs, and a **DLT that acts as a verifiable data registry**.

In this way, we address the holder's ability to present only the required information and nothing more.

We ensure that a verifier can verify who the issuer is and confirm that the claims issued by the issuer have indeed been issued by them.











Wallet -

User Agent



Trust framework goes...

#### SSI and some dangling aspects

Important aspects remain:

- **IDBinding**: How do we know the real identity behind an issuer, holder, or verifier? For this, TSPs (**Trust Service Providers**) are proposed, and these TSPs should be identified in Gaia-X.
- **Proof of Participation**: How do we know if a participant belongs to a data space or not?
- Proof of Issuing Authority: How do we know if a VC (Verifiable Credential) has been issued by an accepted entity?













#### Gaia-X Trust framework

- Here, the Gaia-X Trust framework would map these aspects.
- This framework was presented is widely known in this forum











#### Gaia-X and cross-border systems

The Gaia-X Trust Framework details the processes for determining which TSPs are acceptable and the data structures for defining claims.

According to the DBSA Tech Convergence, TSPs refer to signature systems aligned with **EBSI and eIDAS**, **ensuring cross-border systems**.

**BUT...** 













#### A brand new requirement was born











#### Gaia-X and cross-border systems

The issue is that we need to internationalize the system.

- We must be able to connect to multiple trust anchors depending on the use case, sector, and global location of the trust anchors, issuers, registries, etc.
- These connections need to be interoperable and manage similar standards.
- In this way, we can address requirements for IDBinding, proof of participation, and proof of authority on a global scale.





# What's missing?











What's missing?

#### Gaia X Trust framework current specifications

- Trust Anchors
- Gaia-X Registry
- Verifiable Credentials
- Ontology









What's missing?

#### Aren't we missing something??

A dynamic and standardized protocol for identity verification and secure interaction between entities is currently missing from the Gaia-X specifications.

A similar dynamic protocol approach is being adopted by the W3C in: <u>https://w3c-ccg.github.io/vc-api/#initiating-interactions</u>











#### **GNAP4VP**

A protocol that combines GNAP (for flexible and secure authorization) and OIDC4VP (for verifiable credential presentation)

Due to the nature of GNAP, GNAP4VP can serve as a protocol for dynamically selecting interaction flows.

It interacts with the Gaia X registry and utilizes its standards and ontology.









#### **GNAP4VP**

This protocol has been accepted as a Full Paper at the 22nd International Conference on Mobile Systems and Pervasive Computing (MobiSPC):

"Next Generation Authentication for Data Spaces: An Authentication Flow Based On Grant Negotiation And Authorization Protocol For Verifiable Presentations (GNAP4VP)"



The 22nd International Conference on Mobile Systems and Pervasive Computing August 4-6, 2025, Leuven, Belgium











GNAP Features	OAuth 2.0	GNAP
Authorization Approach	Delegated with access tokens	Flexible and granular control
Flows	Static and predefined	Dynamic and adaptable
Interoperability	Widely adopted	Enhances interoperability at the federated level
Extensibility	Requires custom extensions	Extensible by design with better adaptability









#### Compatibility with Legacy Systems implementing OAuth 2.0

#### **Proxy Translation**



**Dual Stack** 













#### **GNAP4VP** Features



VC-based authentication flow



Dynamic grant negotiation between entities

from OIDC4VP

> Selective disclosure and privacy preservation



from OIDC4VP from OIDC4VP & GNAP & GaiaX

from GNAP



Token issuance post VP-verification

Session and

lifecycle support

Multi-InteractionSupport

from OIDC4VP & GNAP

from GNAP

Safe delegation

from GNAP

from **GNAP** 













#### OIDC4VP

#### Pros

- Main Verification method for Verifiable presentations
- Supports selective disclosure
- Scalable and flexible



#### Cons

- OIDC4VP is authentication-focused, authorization is not integrated
- Authorization logic requires separate protocols
- Lacks fine-grained access control semantics





## **GNAP4VP Flows**



# Flow 1 -Redirect Based Interaction











Flow 1

#### Redirect-Based Interaction

#### Assumptions

- The Consumer already has a Wallet
- The Wallet already contains VCs stating he is a participant in the Data Space issued by a Global Trusted Issuer










Redirect Based Interaction













Redirect-Based Interaction integration with the Gaia X ecosystem

Consumer











Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem













Redirect-Based Interaction integration with the Gaia X ecosystem





# Flow 2 -Software Only LVP Flow











#### Software Only

#### Assumptions

- The Consumer already has a Wallet
- The Wallet already contains VCs stating he is a participant in the Data Space issued by a Global Trusted Issuer











#### Software Only





## **Redirect-Based Interaction Demo**











#### Redirect-Based Interaction Demo





# Thanks Questions?



#### Thank you! Gràcies! Gracias!

Joaquín Salvachúa | joaquin salvachua@upm.esAndrés Muñoz | joseandres.munoz@upm.es

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ICT TECHNOLOGY CENTER



## **Networking Lunch**

#### 13:00 - 14:00

 **Programme Plenary Room** 

14:00 - Keynote: Spanish Plan for the Promotion of Sectoral Data Spaces

14:15 – Gaia-X Certification Programme

14:30 - Tourism, Smart Cities & Mobility Ecosystems Panel

15:15 - Agriculture Ecosystem Panel



## Enhancing Manufacturing Resilience Through Gaia-X – Insights from Flex4Res

#### 14:00 - 14:15

In partnership with gaia-X = Hub Spain





Emmanouil Bakopoulos Research Engineer Laboratory for Manufacturing Systems and Automation (LMS)



## Project



Call: HORIZON-CL4-2022-TWIN-TRANSITION-01 Type of action: HORIZON Innovation Actions Funding: 8 Million € funding amount Starting date: 1 January 2023 End date: 31 December 2025 Duration: 36 months



## The Flex4Res Concept





## Objectives









**Open platform** for secure and sovereign cross-company data exchange **Two toolboxes** for resilience assessment and reconfiguration planning

Industrial data space for sharing digital twin models of production facilities Utilize **Gaia-X**, IDS Reference Architecture Model and **Asset Administration Shell** technology



## Use cases

	Macro level	Meso level	Micro level
Constant reconfiguration of supply plans – <u>Sidenor use case</u>			
Reconfiguration of manufacturing processes during production – <u>Voestalpine use case</u>		voestal	DINE ONE STEP AHEAD.
Production planning optimization – <u>Goimek</u> <u>use case</u>		CC	DIMEK
Reconfiguration measures after a tool change – <u>Hans Berg use case</u>			<b>BERG</b> Forming Technologies



## Flex4Res Approach



- Bridge IDS & Gaia-X through a compute-to-data setup
- Participant can download/ access service from Pontus-X and utilize data that resides:
  - In local sources
  - In Pontus-X
  - In IDS data space
- Enabling services to operate across organizational and system boundaries



## Thank you!

#### **Emmanouil Bakopoulos**

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In partnership with gaia-X = Hub Spain



Flex4Res project Booth number 9



Real-World Gaia-X Trust Framework Implementation with GXDCH and eIDAS

14:15 - 14:45

In partnership with gaia-x = Hub Spain



Marco Penovich, CTO, Dynamo
 The European Cloud
 Alternative
 Alternation

 Maharshi Suchak, Co-founder & Chief Product Officer, SmartSense Solutions



gaia-x

## AGENDA

- Introducing Dynamo
- Architecture with Gaia-X standard as base
- Journey to use eIDAS sign in Production
- DYDCH and GXDCH
- Community contributions
- Hands on
- Next steps



## #GaiaX #MarketX25 #TechX25



gaia-



## Dynamo – OneStopPlace federating European!\*

The first **commercial federation** across **European only market** operators offering Cloud and Digital Solutions

Implement the new concept of a CVSP (Cloud Virtual Service Provider) to increase everyone sales opportunities

Build the **critical mass** and federation necessary to sell, compete, enabling **European Sovereignity** and **Innovation** 



A true Marketplace, not just a catalog of browasable items, to cover the full order to cash process



Automates onboarding, qualification, sales, and provisioning of multi-supplier offerings



Alike a virtual merger enables seamless interoperability across different legal entities

Leveraging Gaia-X Trust Framework to enable and enforce the federation and its trustability





## Dynamo – Players and Roles






# Dynamo – Main flows and Gaia-X TF







# Dynamo - Logical Architecture





# Dynamo – A dive into the DGX module

How we are issuing compliance...



...and let us have glimpse on GXDCH and DYDCH functions





# Dynamo - Based on Let's encrypt

Before Mar 2025, we

could get compliance only from DEV and STAGING servers of Gaia-X...

"type": [				
"VerifiableCredential"				
1,				
"id": "https://compliance.lab.gaia-x.eu/v1-staging/credential-offers/d081ac8f-0d93-4c9e-82d9-1c006e4ec2b6",				
"issuer": "did:web:compliance.lab.gaia-x.eu:v1-staging",				
"issuanceDate": "2025-02-28T13:57:14.957Z",				
"expirationDate": "2025-05-29T13:57:14.957Z",				
▼ "credentialSubject": [				
~ {				
"type": "gx:compliance",				
"id": "https://acme-815600c2a2c12ec0a684.dgx-wizard.dynamo-demo.com/96da9153-17a0-4812-b36e-924c54dd1227/participant.json#0",				
"gx:integrity": "sha256-3c5608352917dbe28ba45016a109e3133f0ac543edd421f7782339fccb044af5",				
"gx:integrityNormalization": "RFC8785:JCS",				
"gx:version": "22.10",				
"gx:type": "gx:LegalParticipant"				
},				
- <b>f</b>				
"type": "gx:compliance",				
"id": "https://acme-815600c2a2c12ec0a684.dgx-wizard.dynamo-demo.com/96da9153-17a0-4812-b36e-924c54dd1227/participant.json#1",				
"gx:integrity": "sha256-e2161061c2cf823a00815c43d2d7df95491643daa1f717008a698d505f4025f7",				
"gx:integrityNormalization": "RFC8785:JCS",				
"gx:version": "22.10",				
"gx:type": "gx:legalRegistrationNumber"				
},				
· {				
"type": "gx:compliance",				
"id": "https://acme-815600c2a2c12ec0a684.dgx-wizard.dynamo-demo.com/96da9153-17a0-4812-b36e-924c54dd1227/participant.json#2",				
"gx:integrity": "sha256-0a0801bcc43034f8a707db4c76be672ae609eece888117680b0cc6d0aabe3c7c",				
"gx:integrityNormalization": "RFC8785:JCS",				
"gx:version": "22.10",				
"gx:type": "gx:GaiaXTermsAndConditions"				
La Gala-X Staging				
• "proot": {				
"type": "IsonWebStopzture/0/0".				
"created": "2025-02-28113:57:14.9/62",				
"prootPurpose": assectionmethod".				
"VerificationMethod": "Gid:Web:compliance.lab.gaia-x.eu:vi-staging#x509-JWk2020",				
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# Dynamo - Based on Let's encrypt ...not enough

...BUT... that **was not enough** for Dynamo purposes!







# Dynamo - Based on elDAS

So, after Mar 2025, enabled to access the Aruba ATP API...





## Dynamo - TODAY





Sian All Select



# **OUR CONTRIBUTIONS**

#### • 2023

- Showcased that TF 22.10 is ready for real-life use cases (1st Winner of Bilbao Hackathon)
- Knowledge sharing workshop in Cologne with eco

#### • 2024

- o Signing credentials without giving private key
- <u>Provide support for LinkML generated SHACL and OWL</u> (2nd Winner of Luxembourg Hackathon)
- $\circ~$  Knowledge sharing workshop in Madrid with eco and Gaia-X Hub Spain

#### • 2025

- Fix compliance credential format update in V2 Loire API
- $\circ~$  Gaia-Sense A chatbot to answer basic queries on Gaia-X and the trust frameworks of Gaia-X
- We have actively contributed in various workshops for spreading the awareness about how easy it is to implement Gaia-X trust framework
- Future
  - We would like to contribute on providing the support for Revocation and renewal of credentials
  - We ask even the Gaia-X leadership team to consider this of importance as this is a thing that enhances our production readiness



# Enough Talk!

- Let's see the product
- with Gaia-X compliance credentials
- in production version 🔆 dynamo

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# Dynamo - Next steps

Dynamo streamlines Gaia-X Trust Framework adoption's complexity to its Participants to give them the best UX.

In our next release is working on implementing:

- an easy to manage, by user, VC's expiration and renewal
- VC attribute's values updates handling together with VC's status management (i.e. standby, revoking, etc.) for SOs





# Thank you!

Marco Penovich | marco.penovich@dynamo.cloud

Maharshi Suchak | maharshi@smartsensesolutions.com

In partnership with gaia-x Hub Spain

ICT TECHNOLOGY CENTER



•**X**• dynamo





## **From Trust to Transaction**

How eIDAS-Based Identities Enable New Business Models in Data Spaces

#### 14:45 - 15:00



## Ronny Stritzke, Software Architect, Bundesdruckerei GmbH



## Introduction

Agenda:

- 1. Trust as the foundation
- 2. eIDAS and digital identity
- 3. Use cases and business models
- 4. Challenges and enablers



## Trust as the Foundation of Digital Transactions

#### Trust is essential for:

- + Data sharing between unknown parties
- + Legal and regulatory compliance
- + Auditability and accountability



Trust is the currency of the digital economy

# gaia-x

## What is elDAS?

#### Key components:

- + Qualified electronic signatures
- + Electronic seals
- + Digital identities (natural/legal persons)

# eIDAS 2.0: EU Digital Identity Wallet (EUDI)

# eIDAS Electronic Identification, Authentication and Trust Services





# **Digital Identity in Data Spaces**



#### Identity ensures:

- + Who is sharing/accessing data
- + Legal attribution of actions
- + Authorization and consent

Role of:

- Verifiable Credentials
- Decentralized Identifiers (DIDs)



## From Trust to Transaction



#### eIDAS-based trust enables:

- + Data monetization
- + Legal enforceability
- + Automated processes

## Trust $\rightarrow$ Identity $\rightarrow$ Authorization $\rightarrow$ Payment $\rightarrow$ Legal transaction



## Example Use Case – Healthcare Data Space

#### Actors:

Hospitals, pharma companies, device makers

#### Data:

Anonymized records, telemetry, trial data

#### eIDAS ensures:

- + Proven identity
- + Consent traceability
- + Cross-border compliance





## New Business Models Enabled

#### **Business Models:**

- + Data-as-a-Service (DaaS)
- + Identity-as-a-Service (IDaaS)
- + Verified Data Marketplaces
- + Usage-based billing with legal backing

### Enablers:

- + Gaia-X Trust Framework, EBSI, IDSA
- + Public-private partnerships
- + Regulatory & technical interoperability
- + EU Digital Identity Wallet rollout (2027)





## Conclusion

eIDAS-based identities unlock trusted, compliant, monetizable data transactions



Trust is a value driver, not a cost



Gaia-X enables innovation in data spaces





# Thank you!

Franz Fries-Henrich

Ronny Stritzke | ronny.stritzke@bdr.de

## **Standardisation around** Gaia-X

#### 15:00 - 15:15

**ヽヽヽ**//

In partnership with ----111111 gaia-x 💶 Hub Spain



#### Pierre Gronlier, CINO, •0 Gaia-X

gaia-x



# Standardisation updates

Pierre Gronlier, Gaia-X





- The Gaia-X design principles are now included in the CEN/CENELEC Trusted Data Transaction (TDT) 🎉
  - The functional requirements for the "Policies, Claims and Evidence" chapter (technical dimension)
  - The functional requirements for the "Trust Frameworks" chapter (organisation dimension)
- CEN/CENELEC Trusted Data Transaction (TDT) is entering the review phase.
  - The next step is the CEN/CLC JTC 25 WG 2 or ISO JTC1 SC38 WG 6.
- Gaia-X is now a liaison organisation with the JCT 25.
- The prohibition about natural person participating in a TDT has been removed.
  - This rule was creating an artificial gravity effect and lock towards platforms and intermediaries.
  - Note: This topic has been heavily discussed, several times, between Dawex/FIWARE/Gaia-X/iShare/TNO and IDSA/Microsoft
  - Note: this should also be removed from the Eclipse Decentralised Claim Protocol.

#### Trusted Data Transaction – example of enablements



- "Claims, policies and evidence work together to establish trust. Automated resolution of policies, claims and evidence relies on technical requirements regarding the metadata." (TDT v240)
  - The **issuer** of each policy, claim and evidence **shall be identifiable**.
  - Each policy, claim and evidence and their object(s) shall be identified with a unique identifier in the context of the issuer of the identifier.
  - The party to which the policy, claim or evidence has been issued shall be verifiable.
  - The content integrity of each policy, claim and evidence shall be verifiable.
  - The validity of a policy, claim and evidence shall be verifiable.
  - Evidence shall be recorded in a manner that enables both manual and automatic validation.
  - Claims should be **presented in a machine-readable form** according to the state of technology

=> It's Gaia-X ready with Verifiable Credential + resolvable identifiers 🦾 <=

#### **Eclipse Foundation**



- In the Eclipse Dataspace Working Group (EDWG), Gaia-X contributions to the Eclipse Conformity Assessment
   Profile (CAP) have been released in April as v2.0
  - Current testing projects : Gaia-X Label level 2&3, CISPE, DOME, Fulcrum
- On the path for ISO Publicly Available Specification (PAS) submission with:
  - Specification -> cap.owl.ttl or cap.owl.xml
  - TCK (shape) -> cap.shape.ttl
  - Reference implementation -> cap.py

#### Class: Attestation

issue of a statement, based on a decision, that fulfilment of specified requirements has been demonstrated (ISO/IEC 17000:2020)

• NOTE: this is an abstract class and should not be instantiated directly

#### URI: cap:Attestation



https://github.com/eclipse-dataspace-cap/cap-ontology (v2.1.3) 171

gala-x

#### Eclipse CAP – example of enablements

- Today's challenge:
  - certifications are PDF-based and require intensive manual labor to be assessed.
  - It's expensive and scope is usually vague
- Example with W3C ODRL + Eclipse CAP
  - ODRL:Offer
    - The dataset <idXXX> shall only be processed on ISO
       27001 qualified services in Valencian Community, Spain»
  - ODRL:Request
    - « I would like to consume the dataset <idXXX> and here is the services's ISO27001 certificate hosted in the ES-VC adnimistrative area»



https://www.datacentermap.com

#### **OpenID** Foundation

- Sept 2024: OpenID Connect (OIDC) is now an ISO standard. (ISO/IEC 26131:2024 to ISO/IEC 26139:2024)
- Digital Credentials Protocols (DCP) working group
  - Verifiable Presentation (VP) for Implementer's Draft (ID) v3
  - Verifiable Credential Issuance (VCI) for ID v2
    - adoption by companies: ex in Japan with Authlete (<u>https://www.authlete.com/developers/oid4vci/</u>)
  - High Assurance Interoperability Profile (HAIP) for ID v1
- Kickoff of the Authority Specification
  - Extension to OIDC enabling Relaying Party (RP) to verify relationships claims between natural-natural, natural-legal and legal-legal persons: « Authority to Act », « Human in the loop »
  - Ex of parent and child trust frameworks: COPPA, GDPR, EU Digital Service Act, EU Audiovisual Media Services Directive, Anti-money Laudering Directive, Online Safety Act (UK, IE, AUS, US ...)

# OpenID for Verifiable Credentials (OID4VC) – example of enablements

- Legal person interaction with human-in-the-loop (Includes natural person and legal party.)
  - Kickoff of the Authority Specification: Enable delegation is rights and implicit consent to agent, including AI agent.
  - Extension to OIDC enabling Relaying Party (RP) to verify relationships claims between natural-natural, natural-legal and legal-legal persons: « Authority to Act », « Human in the loop »
  - Ex of parent and child trust frameworks: COPPA, GDPR, EU Digital Service Act, EU Audiovisual Media Services Directive, Anti-money Laudering Directive, Online Safety Act (UK, IE, AUS, US ...)
- World-wide ecosystem adoption with with US (California), EU, Japan, Switzerland
  - Interop participants (<u>https://openid.net/wp-content/uploads/2025/05/OID4VP-Demonstration-May-5-2025-</u> <u>Webinar-Afternoon.pdf</u>)

	Wallet	Verifier
1Password		
Animo/ Funke Wallet		
Bundesdruckerei		
Android		
Open Wallet Foundation		
MATTR		
Panasonic		
Scytales		
Spruce		
Anonymous Corporate		
NIST NCCoE Architecture		
OIDF Certification Test Suite		



## The (new) Gaia-X Conceptual Model

#### 15:15 - 16:00

In partnership with ggia.x Hub Spain  Klaus Ottradovetz, Member of the Atos Scientific community, Atos International Germany GmbH
 Christoph Strnadl, CTO, Gaia-X

gaia-x



# Gaia-X: Vision & Mission

#### VISION

• Enable trusted decentralised digital Ecosystems

#### **MISSION**

• Creating the de facto standard to enable federated and trusted data and infrastructure ecosystems, by developing a set of specifications, rules, policies, and a verification framework



## Framework



Specification, Verification Framework Gaia-X Policies & Rules "Gaia-X Compliance & Labels"



## Use of the Framework for individual Ecosystems



#### **VISION**

Enable trusted decentralised digital Ecosystems

#### **MISSION**

Creating the de facto standard to enable federated and trusted data and infrastructure ecosystems by developing a set of specifications and a verification framework

#### **USECASES**

- Onboarding of participants according to Ecosystem specific Policies & Rules
- Verification of Operators and Services which provide the Ecosystem enabling services
- Verification of individual participants attributes



# Roadmap Exercice: Common patterns





- Analysis of existing (lighthouse) projects and their implemenations
- Co-Design with other associations (e.g. DSBA) and projects (e.g EDWG)



# Gaia-X: Vision & Mission

#### VISION

• Enable trusted decentralised digital Ecosystems

#### **MISSION**

 Creating the de facto standard to enable federated and trusted data and infrastructure ecosystems, by developing a set of <u>specifications</u>, rules, policies, and a <u>verification framework</u>


## **Conceptual Model: Verification Framework**





## **Conceptual Model: Verification Framework**





## **Conceptual Model: Verification Framework**



#### **Conceptual Model: Trust Model**

#### Harmonized conceptual model around trust and its verification





## **Trust Framework**

Digital translation and automation of the rulebook



## Trust Framework

Digital translation and automation of the rulebook





## Federation of Ecosystems



**Participants** offer and/or consume services based on individual negotiation and proof of conformity to the ecosystem rules they connect to

**Ecosystem Operators** can provide services to participants across different ecosystems if they adhere to the compliance rules of (all) the respective ecosystem (s)

**Trust Service Providers** (TSP) can provide services for multiple Ecosystem Governance Authorities (EGA) and to Participants from multiple eco-systems, based on the agreed definitions of the EGAs. TSPs can define trust relationships between each other

**Ecosystem Governance Authorities** can agree on common Policy Rules, Schemas and Trust Anchors and Compliance rules

- Rules applicable to all eco-systems of a particular ecosystem
- Individual agreements between ecosystems These definitions are modular and extensible

## **Ecosystem Interoperability**



Data Space N

Conformity Attes Software Conformity Attes

Participant

Wallet

Dataspace Governance Authorities

DEFINE

**Polices and Rules** 

ASSIGN

Trust Service Providers Operating Companies Gaia-X provides the Specifications and Verification Framework to allow a federated and/or decentralized setup of services that participants can trust as well as it provides trust between participants

Common Specification and Verification Framework allows Federation of Trust across Ecosystems Credentials can be used across multiple ecosystems

#### Automated Onboarding

Identity Provider	Credential Stores (Wallets)	Authorization Services
ODRL Profiles	Vocabularies	Access Services
(general PIP)	Auditing Observability	Value creation services
Marketplaces	Catalogues	Billing & Settlement

A decentralized set of Operating Companies which can serve multiple ecosystems



Property Value Validation

#### **Trust between Participants**



## Ecosystems can trust each others services



#### Data Product Conceptual Model





## **Trust Framework and Dataspace Protocol**



#### **Architecture Document 25.05**

#### Refactoring 3 years of work aligned to our sharp vision



#### 24.04 Version

1 Editorial Information

#### 2 Context

- 3 Models and Components
- 4 Component details
- 5 Operating Models
- 6 Gaia-X Trust Framework Components
- 7 Enabling and Federation Services
- 8 Other Concepts

#### 9 Annexes

#GaiaX #MarketX25

#### 25.05 Version

- **1 Editorial Information**
- 2 Introduction
- 3 Context

#### **4 Gaia-X Trust Framework Architecture**

5 Gaia-X Implementation of Trusted Data Transactions

6 Gaia-X Technical Compatibility Specification

#### 7 Annexes

2025 TC Roadmapping Exercise

qaĭa-x

#### **Architecture Document 25.05**

#### Structure follows our two-pronged trust framework layout



#### 1 Editorial Information

#### **2 Introduction**

#### 3 Context (Understanding the Gaia-X Digital Ecosystem)

- Understanding ecosystems and data spaces
- Gaia-X High Level Positioning
- Aligning with Other Initiatives

#### 4 Gaia-X Trust Framework Architecture

- Elements of a Trust Framework
- Using the Trust Framework
- make "trust talk" more precise
  includes "compliance rules" and technical compatibility

Standards: CEN/CLC, EF

Associations: IDSA, FIWARE, BDVA, DSBA

Projects: DOME, SIMPL, DSSC, 8ra

- Gaia-X Conceptual Model
- Cross-Ecosystem Interoperability
- Service Composition
- Ecosystem Trustworthiness
- Data Space Architectures Usin Framework

demonstrate how the Gaia-X Trust Framework **complements** existing data space concepts

#### 5 Gaia-X Implementation of Trusted Data Transactions

Data Product Conceptual Model

#### 6 Gaia-X Technical Compatibility Specification

- Understanding Identity & Identifiers
- Using Linked Data

- Participant Credentials
  Service Credentials
- Using Verifiable Credentials <</li>
- VC trust triangle (issuer holder – verifier) as the very foundation of everything
- Verifying Gaia-X Credentials
- Gaia-X Credential Format
- OID4VC
- Understanding Ontologies
- Managing Trust Services

#### 7 Annexes

Change Log



C

# Thank you!

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ICT TECHNOLOGY CENTER



## **Networking Coffee**

#### 16:00 - 16:30



Programme Plenary Room 16:30 - Health Ecosystem Panel 17:15 - Manufacturing Ecosystem Panel Data Spaces Specification language (DSSL) and its Maturity and Interoperability Score

#### 16:30 - 17:15





- Joaquín Salvachúa, Profesor Títular, Universidad Politécnica de Madrid
- Andres MuñozGabriel Huecas



# EUNOMIA Εὐνομία

## Expanding Data Space technology base



**Financiado por** la Unión Europea **NextGenerationEU** 



TRANSFORMACIÓN DIGITAL FUNCION PUBLICA



SECRETARÍA DE ESTADO DE DIGITALIZACIÓN

E INTELIGENCIA ARTIFICIAL

aaia-x

Plan de Recuperación



INSTITUTO NACIONAL DE CIBERSEGURIDAD















#### Joaquín Salvachúa

UPM professor that has been involved into formal method for specification and verification of protocols. Multimedia and real time protocols (coauthor of an RFC). Teaching over Cloud infrastructure, Big data infrastructure and Blockchain and DLT technologies.



#### Andrés Muñoz-Arcentales

Assistant Professor at UPM and a Senior Researcher in the Next Generation Internet Research Group (GING/UPM) with main research interests in the fields of Smart Spaces, Data Fusion, Data Spaces, Machine Learning, Digital Twins, Cloud and Edge Computing and Big Data infrastructure.



#### **Gabriel Huecas**

PM professor that has been involved into formal method for specification and verification of protocols.

Plan de Recuperación, Transformació

Part of undergraduate and postgraduate courses in the areas of information theory, data transmission, programming techniques and development of mobile applications.













#### GING - UPM

We all belong to here: <u>https://ging.github.io/</u> Research group GING at the Polytechnic University of Madrid.

Our research focuses mainly on protocols and WWW standards and technologies applied to numerous use cases. Currently, we are **focused on research in cloud computing**, education, learning analytics, **data engineering**, distributed videoconferencing systems with WWW standards, **LLMs and AI**, **open data**, **and data spaces**.

Participation into **several standardization committee**. Participation into IETF, W3C, ETSI and other standardization bodies.











#### What is Eunomia?

Eunomia (Euvoµia ' good law ') was the goddess of laws and legislation.

It was associated with the internal stability of a state, including the enactment of good laws and the maintenance of civil order. She was also the spring goddess of green pastures (nomia in Greek). Eunomia was one of the Horai (Horae), goddesses of the seasons and guardians of the gates of heaven. Her sisters were the goddesses Dike (Justice) and Eirene (Peace). Its opposite was Dysnomia (Anarchy).















#### **Our Mission**

We work on **various levels**, attempting to **fill some gaps** within data space architectures and **predict some future lines**, some of them like the following:

- Evolution of transport protocols
- Covering data governance and **distributed data governance requirements**
- Addressing trust anchor systems beyond European borders
- Use of self-sovereign identity, **SSI**
- Application of **ODRL**, Zero Trust, and **ReBAC** for policy management
- Metadata for data spaces
- Use of **DataLakehouse** architectures applied to data spaces
- High-speed transmission systems
- Integrations with **FIWARE** connectors

## #GaiaX #MarketX25 #TechX25

Project supported by INCIBE

EUNOMIA-Soluciones para la soberanía, confianza y seguridad en los espacios de datos

*C.128.23 EUNOMIA, C130.23 MCIPYME* 



# Interoperabilidy



## Interoperability between data space

- What is a Data Space?
- Are there different Data Spaces?
- May they interoperate easily?
- How we may specify what each Data space instance behaves and interoperate with others?



# What are the steps (workflow) for a data space;? (some of them, an example)

- Define data to be shared.
- Define conditions under which the data may be shared.
- Publish the data in a catalog.
- Get rights for data : instantiate conditions of access/usage/release of data.
- Authentication for data access.
- Data access control
- Data transmission (batch)
- Data usage control and governance
- Post data usage control.



## Workflow



## Define workflow

- Usual approach :
  - DAG : Directed Acyclic Graph (no loops).
  - Easy to navigate.
  - Event based : Event transition system.
- Common for most Big Data infrastructure :
  - Different tools and languages
- Even BMP (Business Process Management) like

# Sarah Connor watching you use AI for everything







## Use the AI Domain Definition Language

- The AI Domain Definition Language (AIDDL) is a modeling language designed to describe, integrate, and manage complex AI workflows and systems.
- It enables developers to define problems, data, and the connections between various AI models-such as planning, learning, and reasoning-in a unified, implementation-independent way.
- Lets use it to integrate Agentic AI to define and help with the Data Spaces definitions.



## AIDDL

- Key Features
  - Integration Across AI Disciplines: AIDDL allows seamless integration of different AI components (e.g., automated planning, machine learning, reasoning) into a single workflow.
  - Modular and Extensible: New types, data, and functionalities can be defined within the language, making it adaptable to any AI problem or domain.
  - Language-Agnostic Modeling: Workflows and interactions are described at the model level, not tied to any specific programming language, which simplifies system upgrades and maintenance.
- Use AIDDL for Workflow Modeling
  - Simplifies Integration: Model how AI methods interact without worrying about low-level implementation details.
  - Supports Complex Systems: Combine simple, well-tested AI components to build complex, robust workflows.
  - Transparency and Maintainability: Easier to understand, explain, and update AI systems as technology advances.



## Possible ODRL profile

- Reuse the expressivity of ODRL in order to stablish things that may be done (and also things not to do).
- This may be the "low level" language

- This will be introduced to the W3C
  - ODRL working group (and 3.0 semantic)





## Score

## Data spaces score

Needs:

- Simple to understand model
- Multiple independent planes: multivariable
- Different valuation schemes
- Possibility to generate a scalar (score) (function to be defined)

A multidimensional representation in a star graph, where each axis reflects the level of maturity in one dimension: technological, legal, access, interoperability maturity, ....

It is proposed that each axis has a rating from 0 to 5 (stars), since it is a simple measure, understandable at many levels and easy to rate, with the possibility of a qualitative assessment (No, bad, fair, normal, good, outstanding).





## Possible categories : ongoing work

#### Legal Axis

- 1. No regulation
- 2. Manual of good practices
- 3. Institutional regulation (company, public administration,...) through internal evaluation or similar
- 4. Local regulation
- 5. National regulation

#### International regulationEje de Accesibilidad

- 1. Owner/undocumented access
- 2. Defined and public protocols/interfaces
- 3. API technologies (REST, SOAP, ....)
- 4. Well-defined and documented interfaces

Standardized open interfaces

#### Data Quality Axis

- 1. Raw data, with no known syntax/semantics, as obtained from the source
- 2. Documented-formatted data (syntax)
- 3. Formatted and Semantic Data (Ontology)
- 4. Cleaned data (clean of errors, )

#### **Business Axis**

- 1. Unintentional data, exploratory offersI
- 2. nternal exploitation (self-consumption)
- 3. Peer-to-peer exploitation
- 4. Exploitation of third parties
- 5. Business proposal, simple buying/selling
- 6. Business plan in operation



## Conclusions

- We believe a Domain specific language will help to clarify Data Spaces interoperability.
- Taxonomy of the different Steps:
  - Required interactions / negotiations.
- Define a workflow between them (even may be linear)
- Double stack approach for compatibility with transport protocols.
- May be used to identify what aspects may be improved in a data space
- Possible compatibility with IEEE P3158 Trusted Data Matrix



## Thank you!

#### Joaquin Salvachua | joaquin.salvachua@upm.es

In partnership with gaia-X Hub Spain







# Thanks Questions?



Financiado por la Unión Europea NextGenerationEU



MINISTERIO PARA LA TRANSFORMACIÓN DIGITAL Y DE LA FUNCIÓN PÚBLICA



SECRETARÍA DE ESTADO

E INTELIGENCIA ARTIFICIAL

DE DIGITALIZACIÓN

Plan de Recuperación, Transformación y Resiliencia



INSTITUTO NACIONAL DE CIBERSEGURIDAD
## Wrap up & Q&A

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## 17:15

In partnership with gaia-X = Hub Spain



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gaia-x



## Networking Cocktail & Dinner

## 18:00 - 21:00

In partnership with gaia-X Hub Spain

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