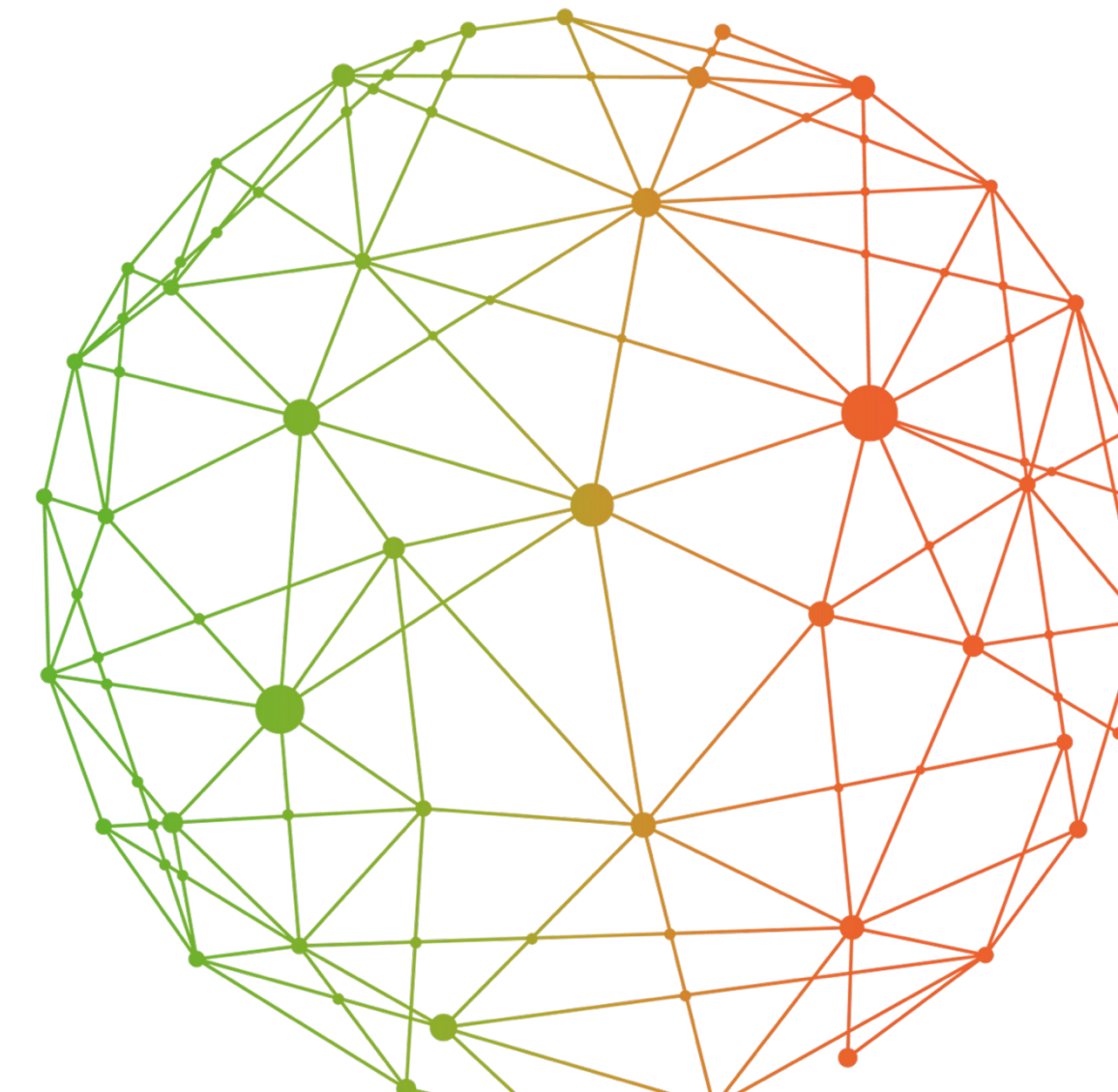


AgrospAI – Agrifood data space for sovereign data sharing and AI services

Towards development of the agriculture data spaces

Data Spaces Symposium 2025

Roberto García, Universitat de Lleida, Spain



DSBA



INTERNATIONAL DATA
SPACES ASSOCIATION



DATA SPACES
SUPPORT CENTRE



Funded by
the European Union

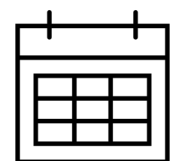
The Data Spaces Support Centre receives funding from the European Union Digital Europe
Programme under grant agreement n° 101083412



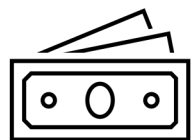
AgrospAI

Spanish call for sectorial data spaces

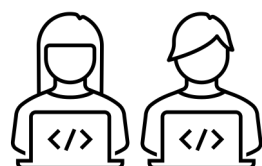
Agri-food data space demonstrator for sovereign data sharing and Artificial Intelligence services



Dec'24 – Dec'25

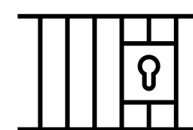


750K €



6 consultants

For participant onboarding and use case deployment



Sovereignty by design

Guarantee control on sensible and personal data

2020 2021 2022 2023 2024 2025 2026 2027



[ANGLIRU](#) (PID2020-117912RB-C22) funded by MCIN/AEI/10.13039/501100011033



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AgrospAI

Initial AgrospAI Ecosystem

- Data providers:



Spanish pig sector cluster



Catalonian agriculture machinery manufacturers cluster



Plant Health Defence Associations of Catalonia

- Data processing services providers:



- Federated data spaces:



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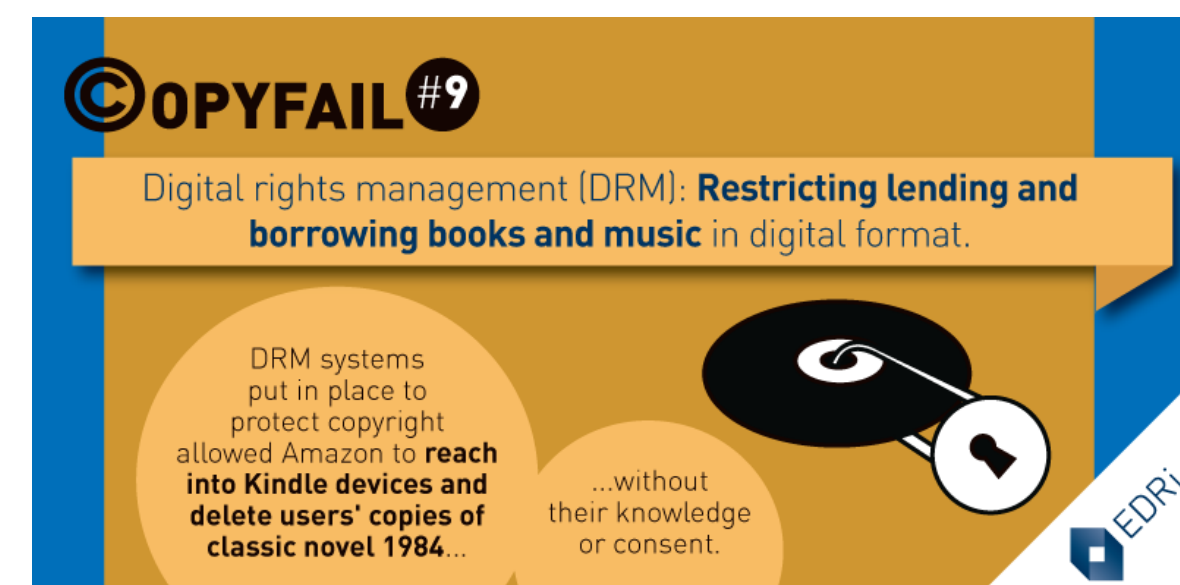
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AGENCIA
ESTATAL DE
INVESTIGACIÓN



1. Data **monetization** (tokenization) as an **incentive**
2. Trustful environment for data sharing without losing their **control**
 - The "tragedy" of the digital, so **easy** to copy and distribute...
 - **Example:** digital music, Digital Rights Management (DRM),... and "**streaming**"
 - For data... **Data Sovereignty by Design?**
 - P2P **Connectors** or **API** Intermediaries
→ **difficult policy enforcement**
beyond trusted environments (like with DRM...)





AgrospAI

Pontus-X: Sustainable Business Models

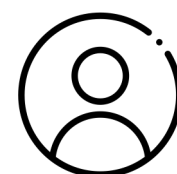
Settle transactions instantly in Euro.
Pay per use and subscription models
for data, AI applications and
infrastructure.

Curated and
trusted data

Applications ,
& AI models

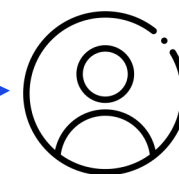
Infrastructure
Resources

DATASET	5 EUROe for 1 hour
+ COMMUNITY FEE	0.01 EUROe
+ ALGORITHM	10 EUROe for 1 day
+ COMMUNITY FEE	0.02 EUROe
+ INFRASTRUCTURE RESOURCES	0.998 EUROe for 600 seconds
=	16.028 EUROe
& CO2 COMPENSATION	0.25 EUROe



**AI &
Software
Owners**

Access data
inaccessible before
for training & sell
high quality
software on
demand



Data Providers

Curate, provide, monetize siloed data & gain
and offer insights on valuable data

AI, Data & Infrastructure Markets



Control



IP – and privacy
preserving



Trustless/
self-verifying



Consumers

Consume data
products off the
shelf.



Infrastructure & Service Providers

Provide execution environments, cloud
services, and more.



Ecosystem & Federation Service Providers and Developers



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y Resiliencia



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Data Self-Sovereignty by Design

- **Your data:**
Never “leaves the room”
- **You:**
In **control** on who “enters” and what they “take out” with them

✗ Full or partial copies

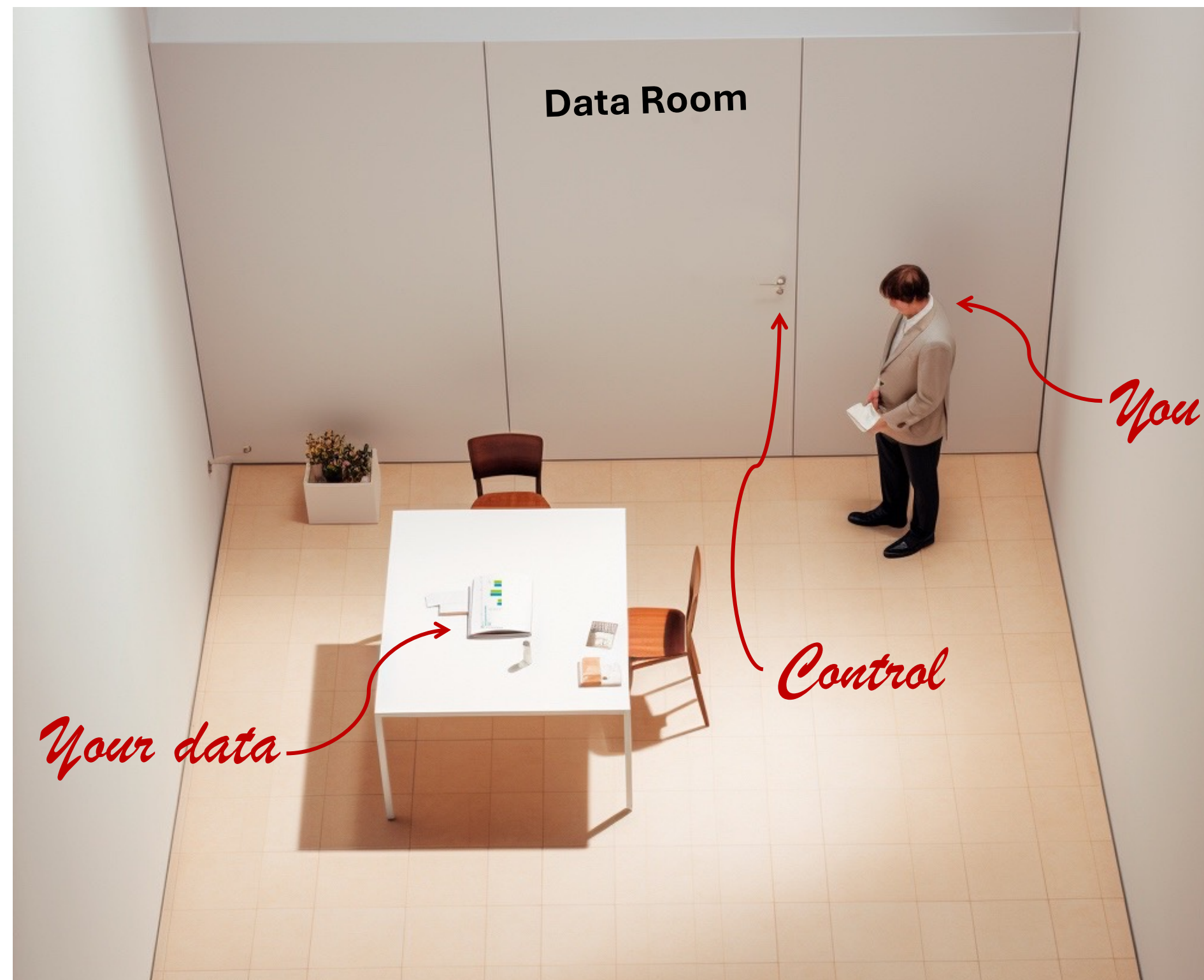
✓ Aggregated data

✓ AI trained models

✗ Personal data

...

dar01995_a_bird-view_of_the_inside_of_a_whole_room_without_wind_1b2e5c91-5513-471d-9673-6c6493a76c11

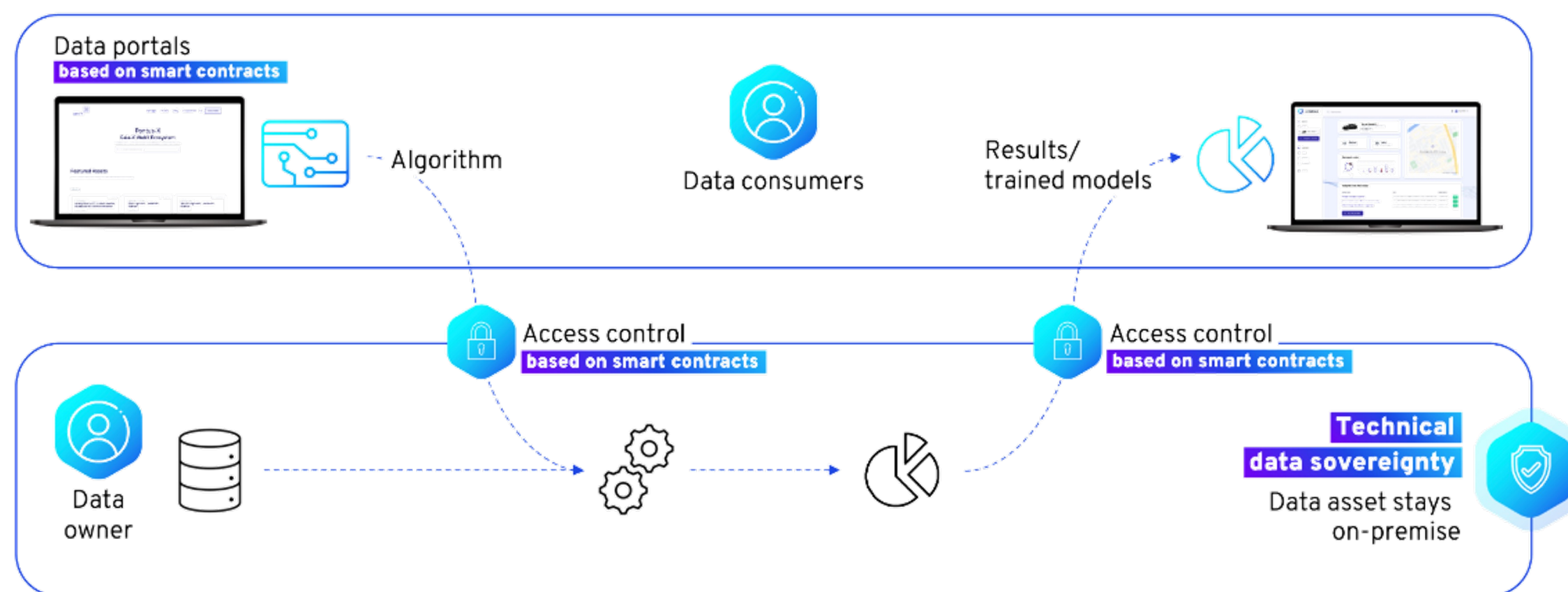


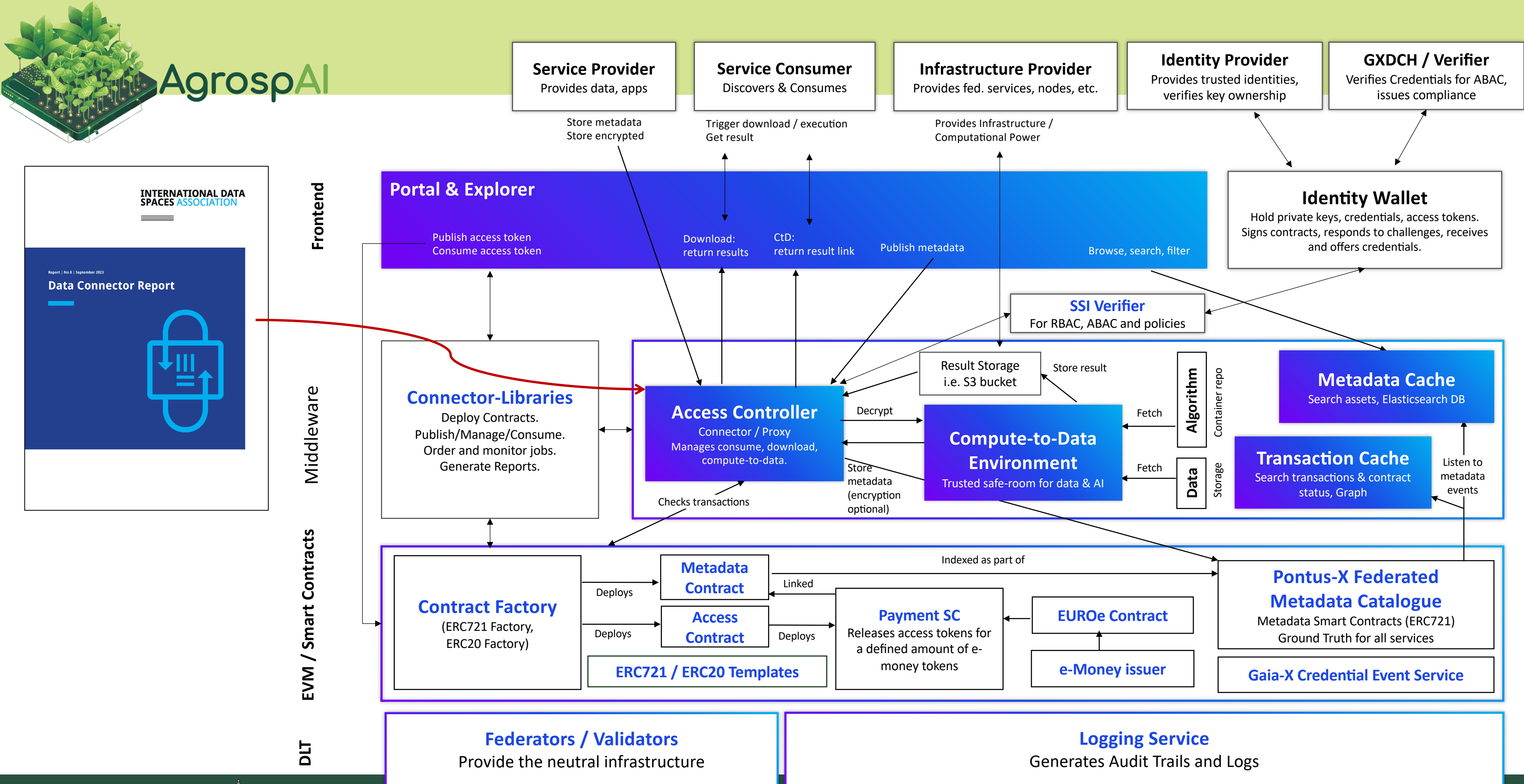


AgrospAI

Compute to Data

- Facilitates providing **privacy** and data **sovereignty** by design
- Algorithms process data where it is stored or in trusted providers
 - Data originators retain **control**, data is **not copied** anywhere







AgrospAI

Gaia-X Integration

Exploratory Data Analysis

GEN-X Testnet

Owned by 0x6207...6822
Accessed with UDL-EDA

Service Credential
Credential ID match
version: 22.10
last check: less than a minute ago

Generate an **Exploratory Data Analysis (EDA)** report for the input tabular data.

The input data is loaded using **pandas** and then the EDA report is generated using **pandas-profiling**. The HTML version of the report can be downloaded when the algorithm

The report includes the following information:

Data Quality Alerts

Overview

Overview Alerts 28 Reproduction

- Alerts
- source has constant value "NASA"
 - Dataset has 10 (< 0.1%) duplicate rows
 - name has a high cardinality: 45716 distinct values
 - recclass has a high cardinality: 466 distinct values
 - GeoLocation has a high cardinality: 17100 distinct values
 - reclat is highly correlated with reclang and 1 other fields
 - reclang is highly correlated with reclat and 1 other fields

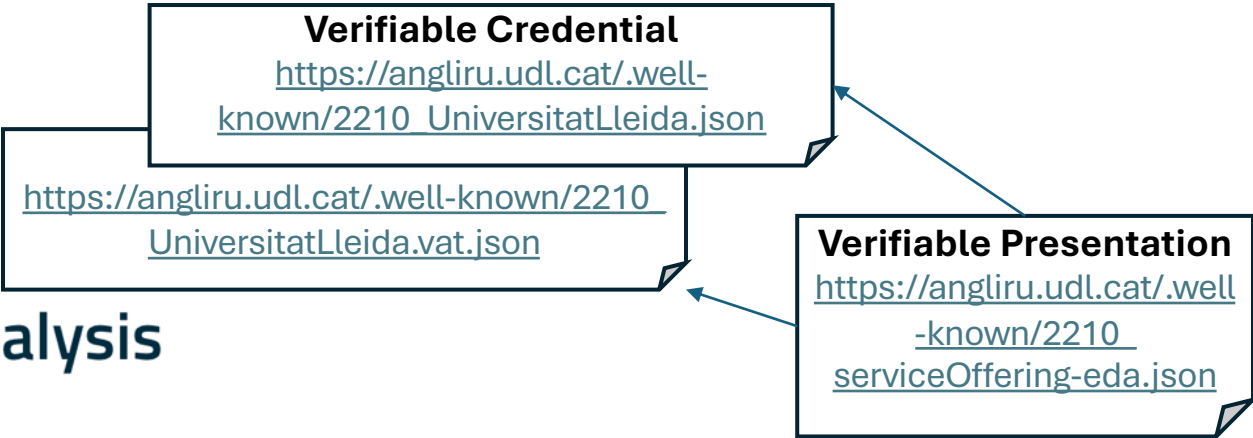
Datasets algorithm is allowed to run on

CEP - Automatic Pig Feeding - 2021 S1 - 982091062894506
CEP-FEED | did:op:bb5f52d48cf3294e8e979ac591ac75830ea98d87308183d389d26620...

CEP - Automatic Pig Feeding - 2021 S1 - 982091062894406 (UdL)
GXAT | did:op:a11ea853ef78f2210e154a9785ac23801880b616fa471dab95b6eeca67bc...

Access allowed

10 sales



gx-compliance 2.0.0 OAS 3.0

Prototype for a compliance service as defined in https://gaia-x.gitlab.io/policy-rules-committee/trust-framework/

credential-offer

POST /development/api/credential-offers Check Gaia-X compliance rules and outputs a VerifiableCredentials from your VerifiablePresentation

Parameters

Name	Description
vcid string (query)	Output VC ID. Optional. Should be url_encoded if an URL Example : https://storage.gaia-x.eu/credential-offers/b3e0a068-4bf8-4796-932e-2fa83043e203

Request body required application/json

A VerifiablePresentation in JSON-LD or JWT format

Examples: Participant

PONTUS-X Testnet Explorer

Blocks Transactions Tokens APIs

Search by address, token symbol, name, transact

Daily transactions

Average block time 4.2 seconds

Total transactions 26,603

Total blocks 13,052,368

Wallet addresses 4,193

Blocks

13052367 0 Transactions 8 seconds ago Miner 0x00000000000000000000000000000000... Reward 0 GX

13052366 0 Transactions 10 seconds ago Miner 0x00000000000000000000000000000000... Reward 0 GX

13052365 0 Transactions 12 seconds ago Miner 0x00000000000000000000000000000000... Reward 0 GX

13052364 0 Transactions 14 seconds ago Miner 0x00000000000000000000000000000000... Reward 0 GX



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Agri-food Data Space Demonstrator for Sovereign Data-Sharing and Artificial Intelligence Services



AI-based Animal Well-being Assessment without Images Leakage

COMPUTE

ALGORITHM

CVC-SEG-T

Image Recognition and Tracking for Animal Well-being Monitoring
Universitat de ...

A computer vision service developed by the Centre de Visió per Computador (CVC) performing automatic image segmentation and tracking to identify and monitor pig movements in the input se...

1

4 sales



COMPUTE

DATASET

CEP-PEN-I

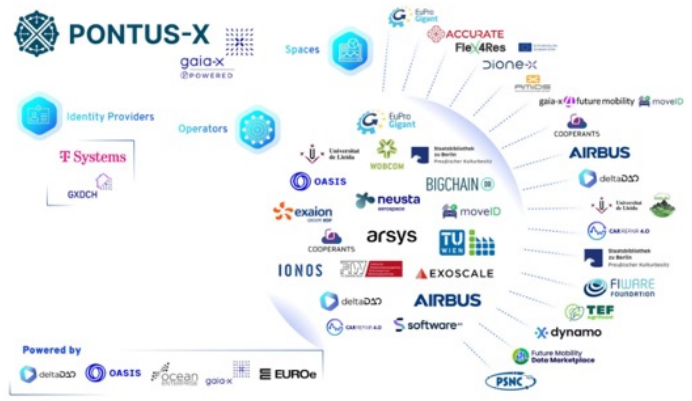
Pig pen images sequence for animal well-being assessment
Centre d'Estudi...

A sequence of images from video surveillance of one of the pens in the Centre of Swine Studies of Catalonia (CEP), an experimental pig farm managed by a consortium made up of the Diputació de Ll...

2,5

4 sales





The Gaia-X Powered Ecosystem on DLT

The principle of decentralization is a perfect fit for **Distributed Ledger Technology**. Ocean Enterprise is a fully open-source technology stack, leveraging DLT and decentralization, aiming to give control back to the owners of data services. Pontus-X is built on top of Oasis Network showcasing how future industrial digital service ecosystems work today.

LEARN MORE ↗

Precision Pig Feeding Semantic Data Integration and Sovereign Data Pooling

COMPUTE

ALGORITHM

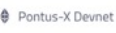
CEP-MP

CEP's CSV Data Mapper and Semantic Data Pooler
Universitat de ...

This algorithm supports the "Pay-as-you-go" approach when sharing data through a data space. Instead of requiring that publish...

Free

2 sales



DOWNLOAD

ALGORITHM

UDL-EDA

Exploratory Data Analysis
Universitat de ...

Generate an Exploratory Data Analysis (EDA) report for the input tabular data. The input data is loaded using pandas and then the E...

0,1 EUROe

17 sales



COMPUTE

DATASET

CEP-FEED

CEP - Automatic Pig Feeding - 2021 S1 - 982091062894496
Centre d'Estudi...

Automatic pig feeding data collected at the (Centre of Swine Studies of Catalonia), a consortium made up of the Diputació de Lleida, the ...

1 EUROe

5 sales

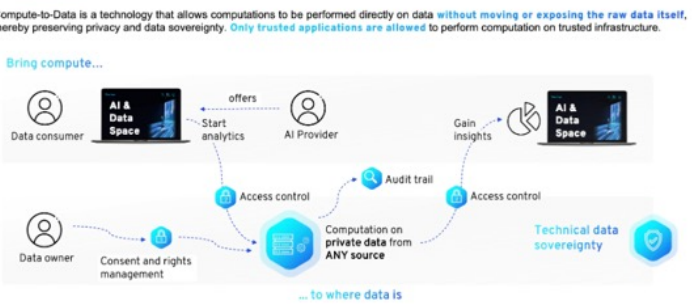


Data Sovereignty by Design

One core concept of AgrospAI is the **Compute-to-Data (CtD)** approach. Compute-to-Data is the functionality that solves the current trade-off between the benefits of using private data and the risks of exposing it. It allows data consumers to run compute jobs on private data while the data stays on-premise with the data provider, who retains control.

LEARN MORE ↗

A safe & compliant environment for AI & data with CtD



<https://agrospai.udl.cat>



AgrospAI

Running use cases

Compute-to-Data
provider at Universitat de
Lleida



Precision feeding



Temp., Hum., CO₂,
Ammonia,...

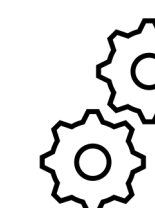
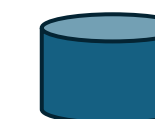
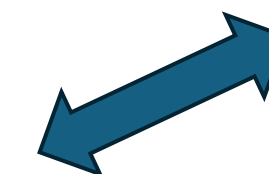
Cameras



Feed & Weight

Environment

Videos



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Pig pen images sequence for animal well-being assessment

GEN-X Testnet

Owned by 0x38f8...840d

Accessed with GXAT ↗

COMPUTE

DATASET

Published about 2 months ago

A sequence of images from video surveillance of one of the pens in the **Centre of Swine Studies of Catalonia (CEP)**, an experimental pig farm managed by a consortium made up of the Diputació de Lleida, the Regional Council of La Noguera, the Torrelameu Town Hall and the Universitat de Lleida.

The images can be used by animal well-being assessment algorithms available from the compute section on the right. These algorithms perform automatic image segmentation and tracking to identify and track pig movements in the sequence of images. Additionally, it is also possible to monitor the visits of pigs to defined areas of interest like the automatic feeding machine or the waterer bowl. This allows for the automatic generation of metrics that can be used for animal well-being assessment.

Data sovereignty is guaranteed by design through a **Data Room** implemented using "Compute-to-Data". The algorithm visits the image sequence inside the data room, where they are analysed, and just the computed metrics leave the room. Consequently, there is no leakage of any image from inside the farm. They are just copied to the data room and destroyed after the computation without leaving it.

The available animal well-being assessment algorithm computes the following metrics from sequences of images:

Movement metric per pig

Example:
{
"0": 2438.4733276550605,
"1": 533.9017133622191,
"2": 1411.6580468122302,
"3": 1481.5184106820652,
"4": 1863.6384070993606,
"5": 2910.0410553493325,
"6": 665.6211681307876,
"7": 702.4427292321657,
"8": 1212.4275062016434,
"9": 1331.9712414388393
}

Time spent on the automatic feeding machine area per pig

Example:
{
"0": { "frames": 5, "time": 0.2 },
"1": { "frames": 0, "time": 0 },
"2": { "frames": 0, "time": 0 },
"3": { "frames": 0, "time": 0 },
"4": { "frames": 1, "time": 0.04 },
"5": { "frames": 8, "time": 0.32 },
"6": { "frames": 0, "time": 0 },
"7": { "frames": 0, "time": 0 },
"8": { "frames": 0, "time": 0 },
"9": { "frames": 12, "time": 0.48 }
}

Job finished

Pig pen images sequence for animal well-being assessment ↗
GXAT | did:op:1738498c886a4d70914c4b28572cc13a21872c8145ba624i

CIDAI pig farm Mask R-CNN segmentation & Tracking (CUDA) (UDL) ↗
GXAT | did:op:5375665bed1605ab035e0fcac73a440e74092967891e

Results

- RESULTS (output.jpg) - 328.1 MB
- ALGORITHM LOGS - 86.3 KB
- CONFIGURATION LOGS - 2.4 KB
- PUBLISH LOGS - 132 Bytes

Results are stored for 30 days.

CREATED
about 2 months ago

FINISHED
about 2 months ago

JOB ID
3ab78bb144454e2988a098c893e64e47

Select a Compute Environment

UdL Data Room ⓘ
CPU | GPU | max duration: 1 hour
0.01 OCEAN / minute

Select an algorithm to start a compute job

Search by title, datatoken, or DID...

CIDAI pig farm Mask R-CNN segmentation & Tracking (CUDA) (UDL) ↗
GXAT | did:op:5375665bed1605ab035e0fcac73a440e74092967891e
Free

You will pay 0.6 OCEAN ⓘ

ORDER COMPUTE JOB

You bought this dataset already allowing you to use it without paying again. You already bought the selected algorithm, allowing you to use it without paying again. In order to start the job you also need to pay the fees for renting the c2d resources. Please note that network gas fees still apply, even when using free assets.

☒ I agree to the Terms and Conditions

Access allowed 🔒

Your Compute Jobs

HIDE ▲

STATUS	ACTIONS	FINISHED
JOB FINISHED	SHOW DETAILS	about 2 months ago
DATA PROVISIONING ...	SHOW DETAILS	about 2 months ago
JOB FINISHED	SHOW DETAILS	about 2 months ago

- **Compute** animal well-being metrics **without revealing** farm **images**
 - Images and algorithm loaded into the **data room**
 - **Just metrics** can be **downloaded**
- **Monetization:**
 - data, algorithm and computation infrastructure

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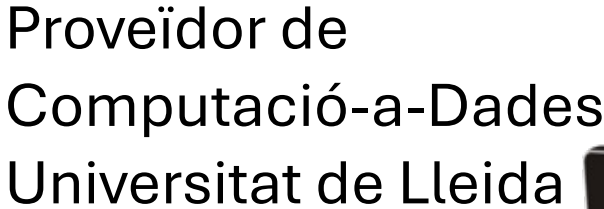
Plan de Recuperación,

Transformación

y Resiliencia



Running use cases





Pen Number	Animal ID	Date	Time	Duration (s)	Feed (g)	Animal Weight (g)
4	982091062894196	2021-03-16	01:08	42	0	16500
4	982091062894196	2021-03-16	01:09	45	1	16300
4	982091062894196	2021-03-16	13:05	70	0	15300
4	982091062894196	2021-03-17	10:44	5	0	14400
4	982091062894196	2021-03-17	10:45	9	6	14500
4	982091062894196	2021-03-17	10:45	50	14	14400

CEP - Automatic Pig Feeding - 2021 S1 - 982091062894196

GEN-X Testnet

Owned by 0x6207...6822
Accessed with CEP-2021-S1-FEED_982091062894196 ↗

DATASET

Published 4 days ago

Automatic pig feeding data collected at the Centre for Pig Studies of Catalonia (**Centre d'Estudis Porcins**), a consortium made up of the Diputació de Lleida, the Regional Council of La Noguera, the Torrelameu Town Hall and the Universitat de Lleida.

The feeding data includes:

- Pen Number:** the pen the pig is located in.
- Animal ID:** the pig identifier.
- Date:** the date the feeding data is about.
- Time:** the time pig feeding happened for the given date.
- Duration (s):** the duration of the feeding event.
- Feed (g):** the amount of food provided, measured in grams.
- Animal Weight (g):** the pig weight, measured by the feeding machine during each feeding event.

udl

pig

agriculture

livestock

feed

automatic-feeding

DATA AUTHOR

Centre for Pig Studies of Catalonia

OWNER

0x6207...6822

DID

did:op:0d9493e7c7be9afdd6119a0099b54347ab053201d04a49ac1090deee8e73e041

Binary
56.98 kB
url

Free

Select an algorithm to start a compute job

Search by title, datatoken, or DID...

Exploratory Data Analysis ↗

GXAT | did:op:e73ac9c332adfea204acefb4b300e...

Free

RML Mapper for Daily Pig Weight CSV Data ↗

GXAT | did:op:f421dff824262a7a61e42370f65cc...

Free

You will pay ⓘ

BUY COMPUTE JOB

You bought this dataset already allowing you to use it without paying again. The C2D resources required to start the job are available, no payment is required for them. Please note that network gas fees still apply, even when using free assets.

Your Compute Jobs

SHOW ▼

2 sales

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CEP's CSV Data Mapper and Semantic Data Pooler

GEN-X Testnet

Owned by 0x6207...6822
Accessed with CEP-RML

COMPUTE | ALGORITHM | Published 2 months ago

This algorithm supports the "Pay-as-you-go" approach when sharing data through a data space. Instead of requiring that publishers integrate the data based on existing schemas, which causes a significant upfront overhead, the pay-as-you-go paradigm favours an incremental approach. This way, entry barriers are lowered and it becomes easier to share data.

Moreover, data sovereignty is guaranteed by design through a **Data Room** implemented using "Compute-to-Data". The mapped data does not leave the room, it is processed and then stored into a Knowledge Graph that stays inside the room. This way, it remains under the control of the data originator, the **Centre of Swine Studies of Catalonia (CEP)**.

Later, CEP can decide to grant access to trusted algorithm to visit the Data Room and slice the Knowledge Graph to extract the semantically integrated data relevant to their computations. Also in this case, data sovereignty is guaranteed as just computation results, like aggregations or AI trained models, can leave the room, not the original data or subsets of it.

Precision Feeding

Temp., Hum., CO2, Ammonia,...

Cameras

Feed and Weight

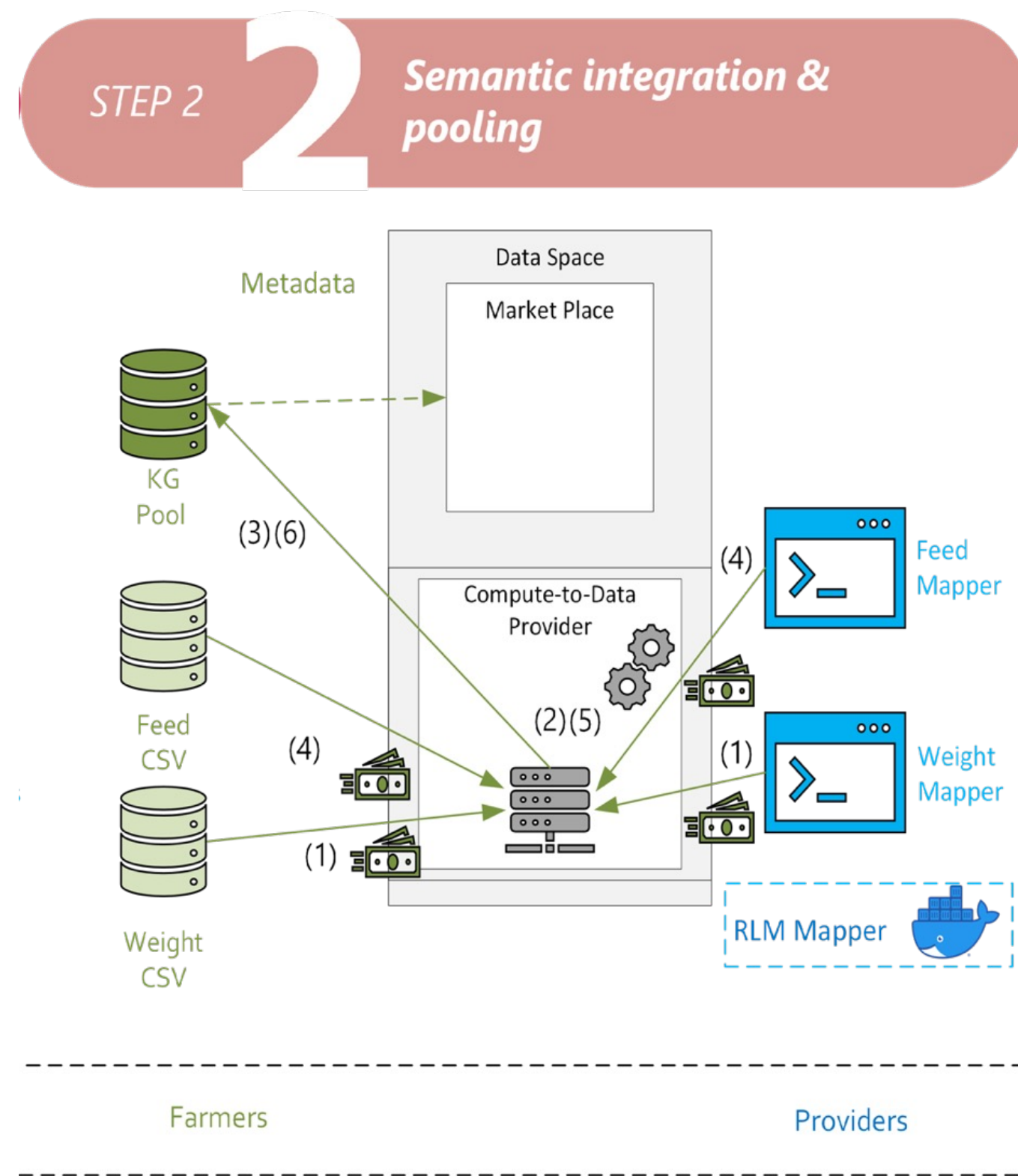
Environment

Videos

Centre d'Estudis Porcins
Centre of Swine Studies of Catalonia

Compute-to-Data Provider
at Universitat de Lleida

Federated network of providers including Airbus, Exoscale, Ionos, Aresys, and others.



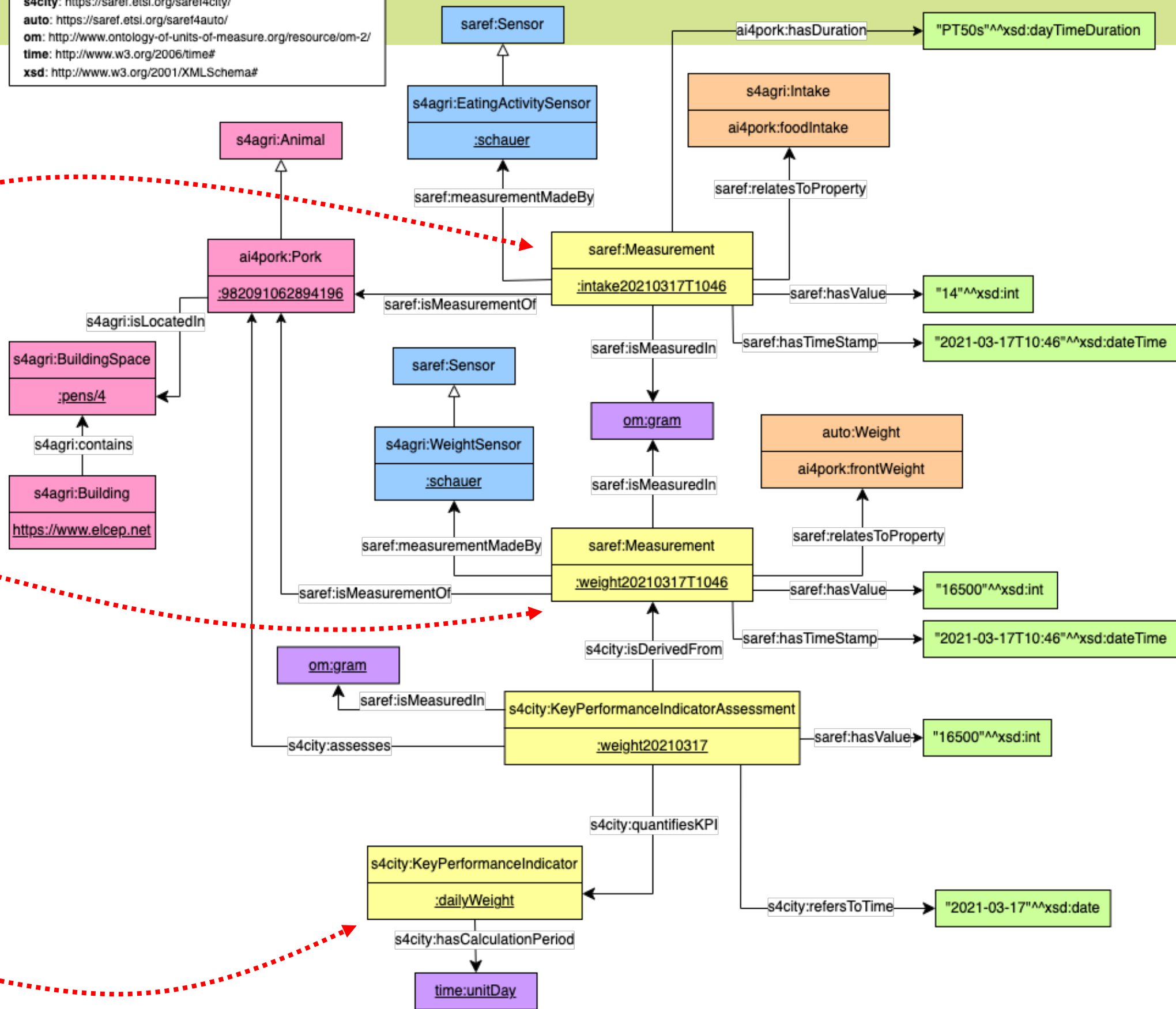
Pen Number	Animal ID	Date	Time	Duration (s)	Feed (g)	Animal Weight (g)
4	982091062894196	2021-03-16	13:05	70	0	15300
4	982091062894196	2021-03-17	10:44	5	0	14400
4	982091062894196	2021-03-17	10:45	9	6	14500
4	982091062894196	2021-03-17	10:46	50	14	16500

Feed CSV

Daily Weight CSV

Animal ID	Date	Weight (g)
982091062894196	2021-03-16	16300
982091062894196	2021-03-17	16500

base: https://ai4pork.angliru.udl.cat/schauer/
ai4pork: https://ai4pork.angliru.udl.cat/ontology/
saref: https://saref.etsi.org/core/
s4agri: https://saref.etsi.org/saref4agri/
s4city: https://saref.etsi.org/saref4city/
auto: https://saref.etsi.org/saref4auto/
om: http://www.ontology-of-units-of-measure.org/resource/om-2/
time: http://www.w3.org/2006/time#
xsd: http://www.w3.org/2001/XMLSchema#





AgrospAI

Next Steps...

- Scaling up:
 - Additional participants
 - New use cases
 - Yield estimation, soil quality reports, plant health data, weed detection,...
- Guidelines for participants
 - How to share data, services and compute
- Developing missing components:
 - Consent management dashboard
 - Data cooperatives (datasets with shared ownership)
- Success stories



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Plan de Recuperación,
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AgrospAI – Agrifood data space for sovereign data sharing and AI services

Towards development of the agriculture data spaces

Data Spaces Symposium 2025



AgrospAI



Universitat de Lleida

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