

Titan Project: A window into the EOSC open science platform. Aragón use case

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TITAN

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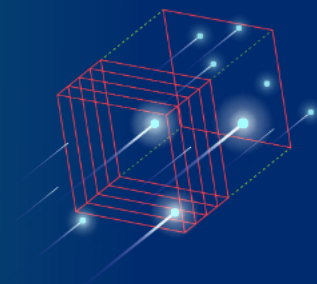


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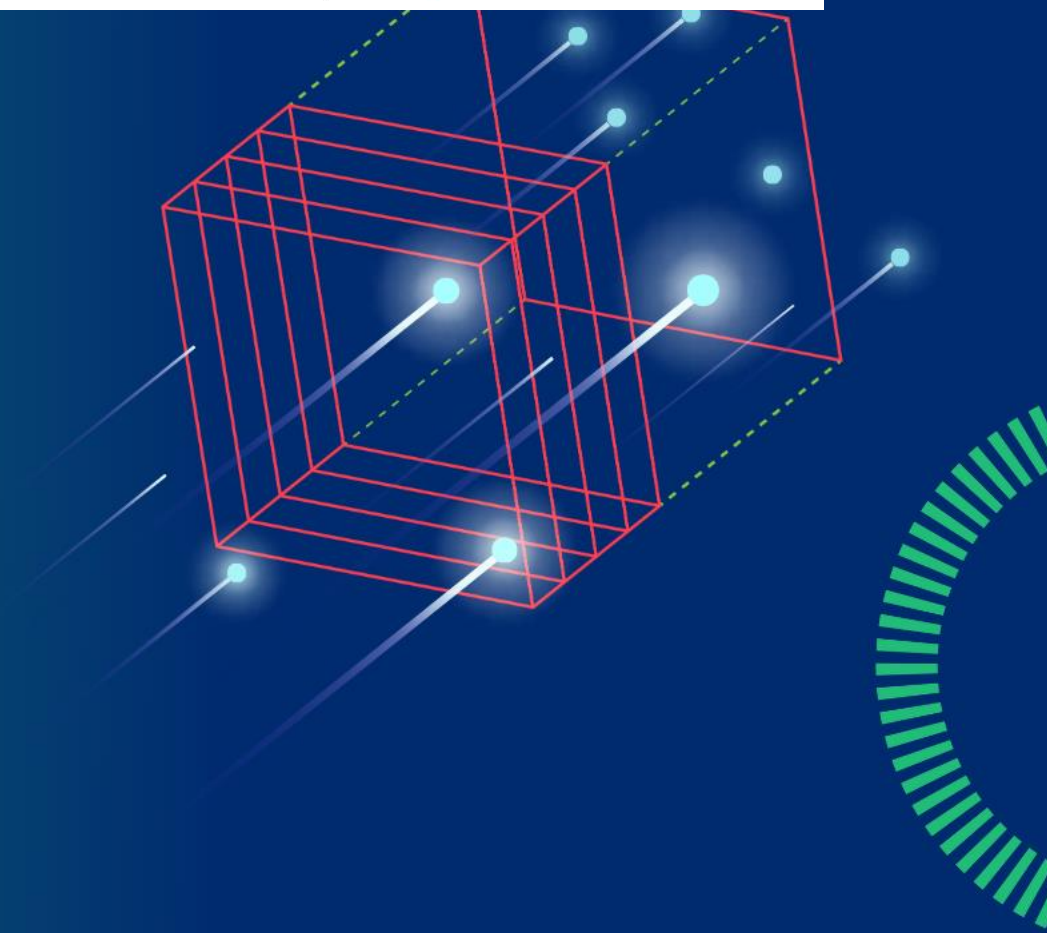
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Agenda

- What is EOSC?
- The project
- Use case 1



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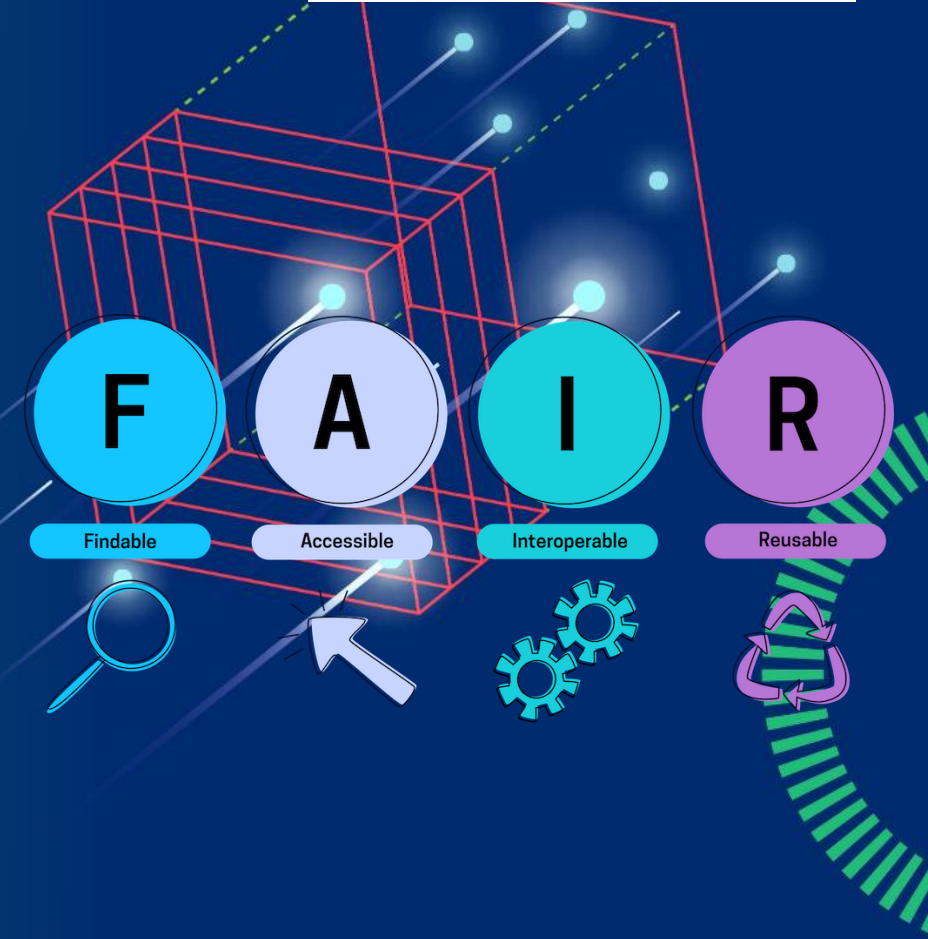


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What is EOSC?



- **EOSC - European Open Science Cloud.**
- It is an EC initiative launched in 2018.
- EOSC provides a federated, multidisciplinary digital environment for researchers to store, access, share, and reuse research data, tools, and services.
- Built on the principles of FAIR data.
- **Aims to accelerate open science, improve research reproducibility, and foster innovation across Europe.**
 - Create a Web of FAIR Data and Services.
 - Enable interdisciplinary collaboration and data sharing.
 - Support digital sovereignty, transparency, and trust in research.



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What is EOSC?

- **EOSCpilot** – Initial pilot exploring technical and cultural challenges.
- **EOSC-hub** – Integration of services into a central hub.
- **OpenAIRE-Advance** – Promotes Open Access and Open Data.
- **PaNOSC** – Focused on photon and neutron science.
- **EOSC-Life** – Supports digital biology collaboration.
- **Regional and thematic expansions:** EOSC Enhance, EOSC-Nordic, EOSC-Pillar, EOSC-Synergy



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The Project.



Trusted environments for confidential AI
computing and secure data sharing

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The project

Objectives: Enriching the EOSC with a software platform solution for confidential data collaboration and secure and privacy-preserving data processing.



Collect legal, technical, and architectural requirements and define a platform architecture for secure sharing of sensitive data and publishing anonymised data sets in the EOSC IF



Develop secure data sharing and auditing mechanisms for sensitive data, including secure data zones, data access control, and end-to-end data protection (storage – transfer – processing)



Develop an end-to-end secure data processing framework for collaborative and privacy-preserving Machine Learning (ML) using Trusted Execution Environments



Implement confidential mechanisms, algorithms, and tools with cloud infrastructure platforms and the EOSC IF, and validate solutions in sensitive data-driven use cases (government and healthcare)



Disseminate and promote the solutions for data governance and stewardship through collaboration with EOSC Partnership initiatives, standardisation, and integrating with the EOSC infrastructure.

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The project



Ambition:

- TITAN aims to create secure, compliant solutions for accessing sensitive public data and enabling data-driven science. It combines legal and technical expertise to support the EOSC Interoperability Framework (EOSC IF) by enhancing data value, reducing management costs, and ensuring EU-compliant data protection.
- Recognizing the complexity of achieving full interoperability—technical, semantic, organizational, and legal—TITAN develops automated tools to bridge these gaps.
- Its solutions help users address regulatory, compliance, and interoperability challenges.
- To ensure practical impact, TITAN integrates its tools with EOSC-compliant data sources and applications, publishing them in the EOSC resource catalogue during the project.

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The project

Vision: New paradigm of secure access to sensitive public data and applications

- **TITAN will focus on end-to-end secure data sharing and collaboration platform** requires advancements in network security, **distributed access control**, security domain segmentation, application of state-of-the-art **protection for data in use**, as well as **usable and scalable data anonymization**.
- Three main areas:
 - **Confidential data processing enabling confidential collaborative data processing:** memory encryption, confidential computing, remote attestation, confidential GPUs, confidential ML.
 - **Scalable data anonymisation for wide data access:** Differential Privacy, k-anonymity, Secure Multiparty Computation (SMC), Multi-Party Computations (MPC), Zero-Knowledge Proof (ZK-SNARKs), and Homomorphic Secret Sharing (HSS).
 - **Distributed access control and transaction logging using decentralised solutions:** blockchain technologies, network security domains, cloud security zones, access control and management.

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The project

Approach: New paradigm of secure access to sensitive public data and applications

- Data protection regulations for cloud hosted workflows across computer centres in different countries/regions
- Data anonymization using synthetic data
- Federated data quality assessment and orchestration of distributed execution of analyses
- Collaborative data access based on Trusted Execution Environments
- Confidential Computing Environment and Workload Lifecycle Management
- Software support for Confidential GPUs
- Distributed and Federated Trust Management
- Access Control and Trust Management
- Access control management and access audit
- Trusted Execution Environment-Based Smart Contracts
- Collaborative and Federated Machine Learning

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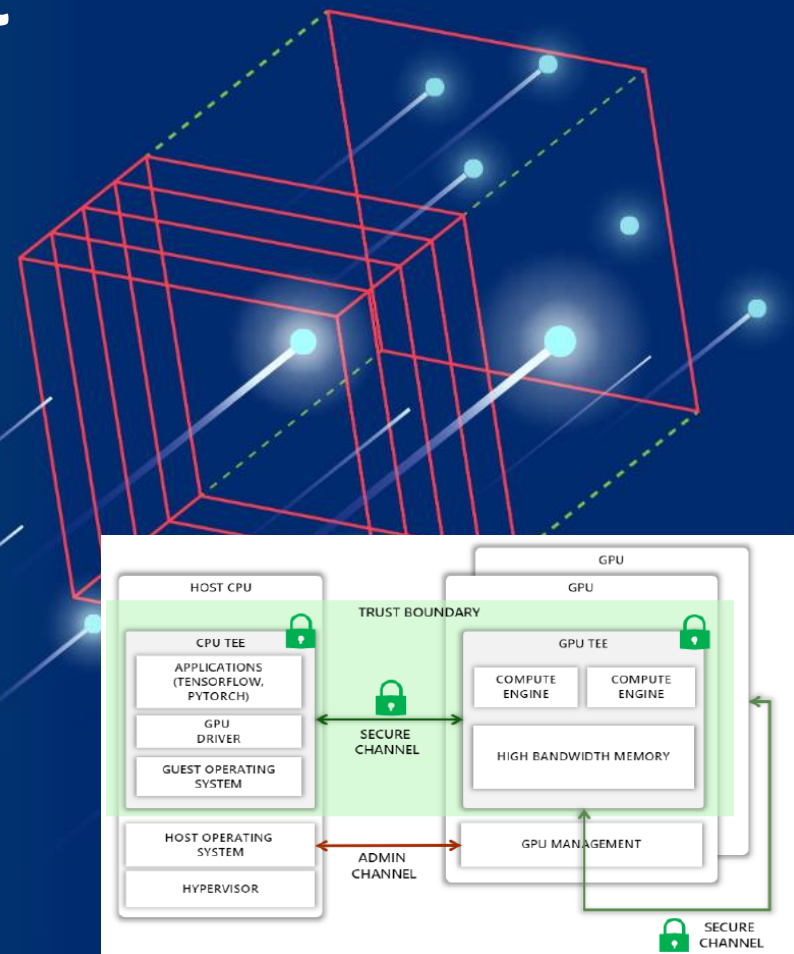
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EOSC-TITAN. The project

Innovations

- **Privacy-preserving, collaborative (confidential multi-party) ML** by combining the aforementioned techniques and leveraging Federated ML. To achieve immutability of the learning data model, the model will be stored on the **distributed ledger**.
- Discovery, sharing, and federation of heterogeneous data from multiple sources, **semantic interoperability data models**.
- TEEs to implement confidential data processing for the shared datasets
- TITAN will develop an improved **access control management ecosystem** through the **application of DLTs**, and more concretely **smart-contract-enabled blockchains**.



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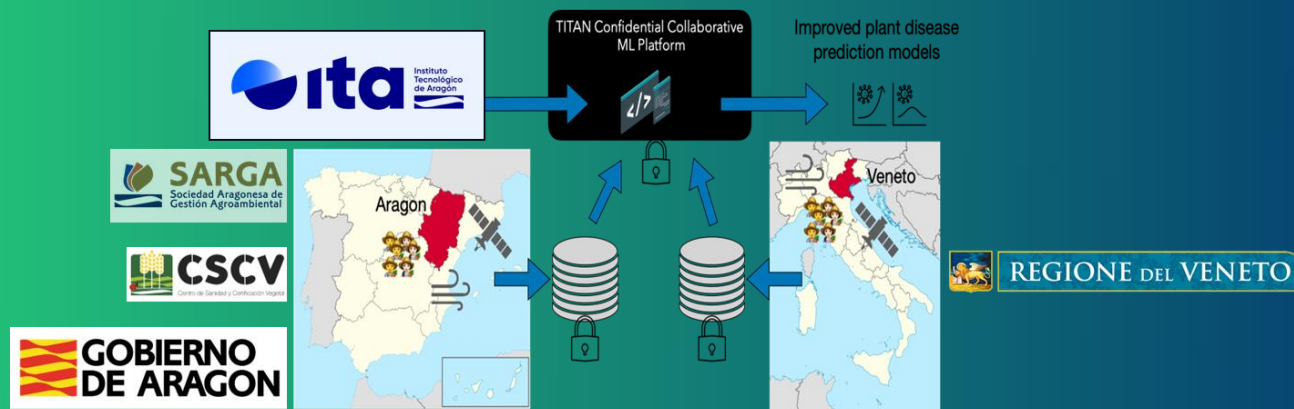
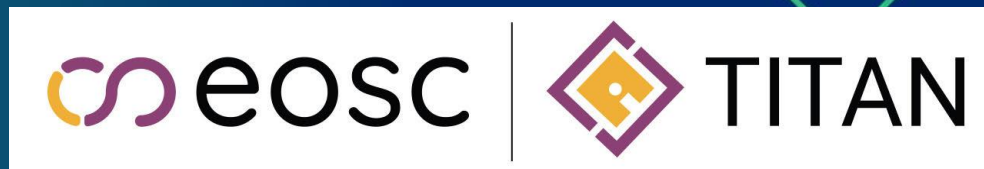


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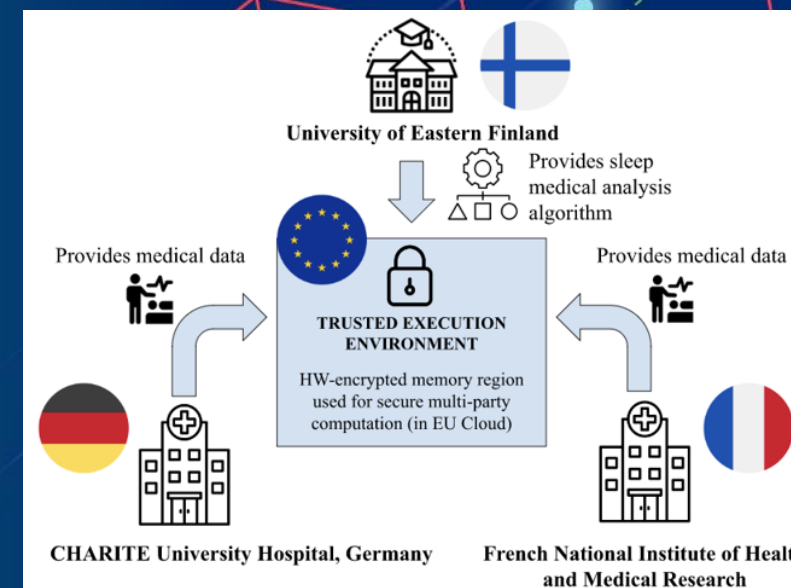


The project

Use Cases



Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.



Use Case 2: Collaborative Use of ML in Healthcare.

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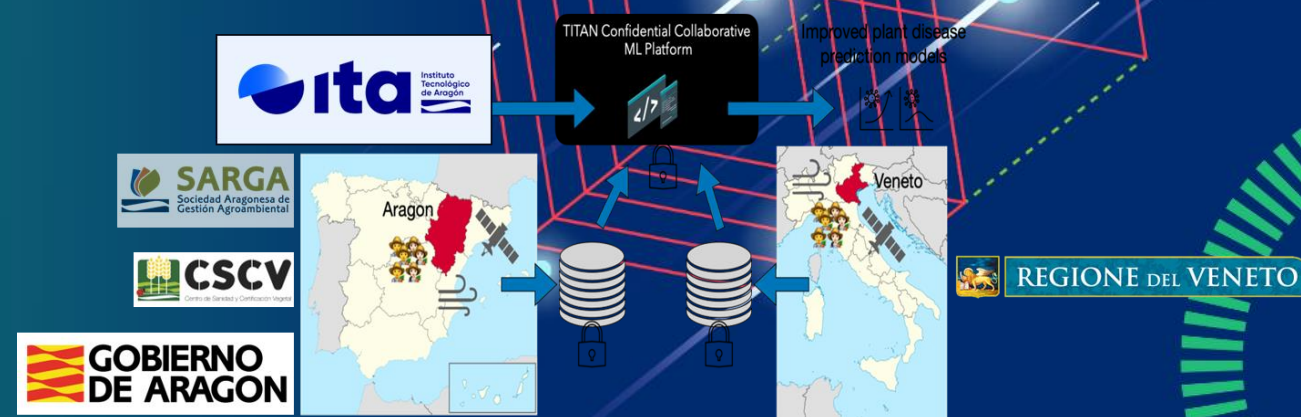
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Use Case 1

Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Objective: Create predictive models for phenology and pest risk in vineyards using shared data from the regional governments of Veneto (Italy) and Aragón (Spain), applying machine learning algorithms while ensuring data privacy and security.



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Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Key use case validation:

- Dataset building:
 1. identifying most valuable data sets capable of helping prediction of plant diseases and improving decision support tools;
 2. identifying a narrowed-down list of specific data sets for secure sharing and scope-limited processing in the TITAN collaborative platform;
 3. extracting relevant data from documentation using Natural Language Processing (NLP) and anonymizing it where relevant.
- ML training over the aggregated data sets, using ML models, deployed on the TITAN confidential ML collaboration platform.
- Implementation and evaluation of the demonstrator:
 1. benchmarking the quality of the decision support tool before TITAN;
 2. assessing if the contributed data sets are sufficient for improving the decision support tools;
 3. comparing the decision support tool performance with and without TITAN.

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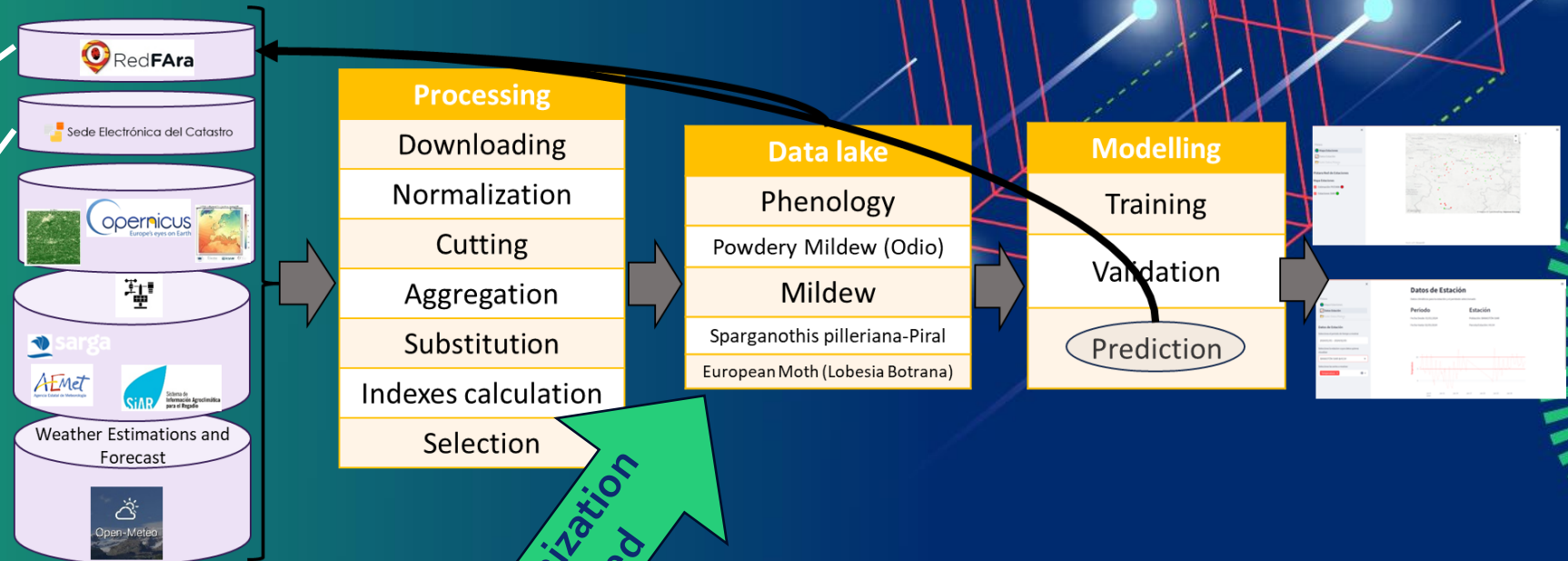
Use Case 1

Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Centralized Approach:

Phenological Data
Pest Data

Parcel Plot



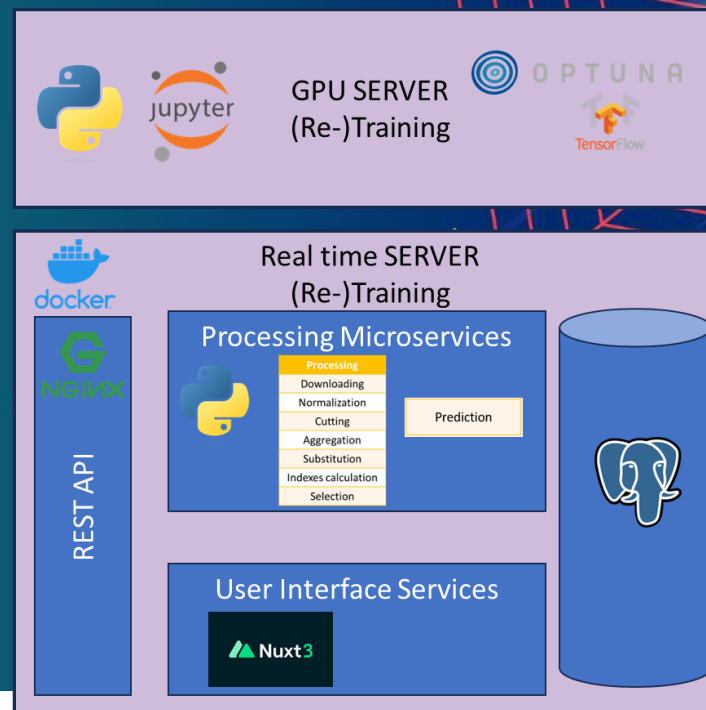
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Use Case 1

Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Centralized Approach: System Architecture



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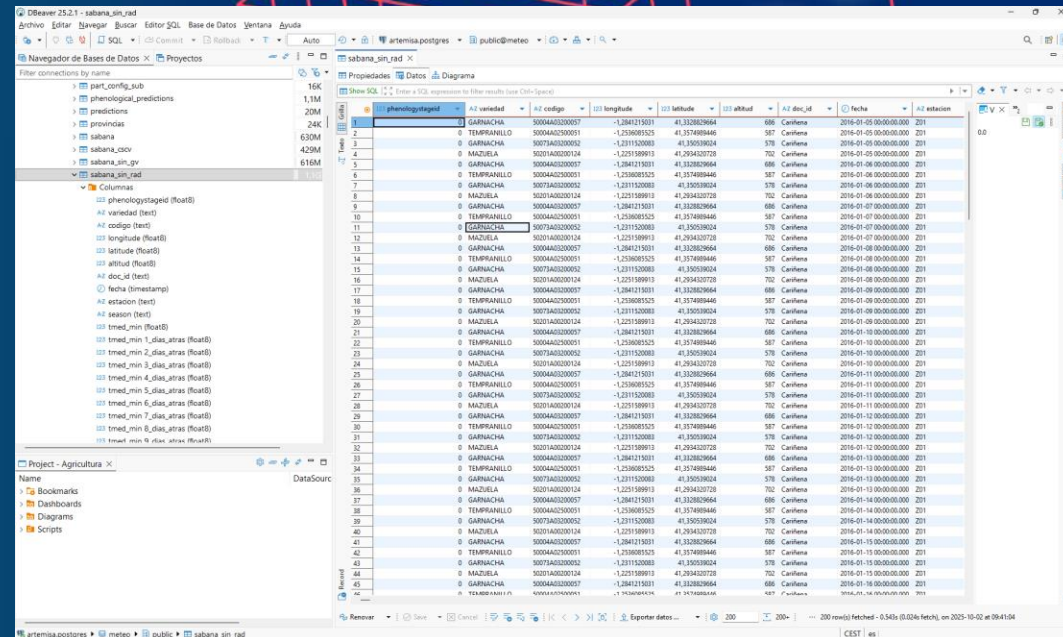


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Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Centralized Approach: Available Data Set

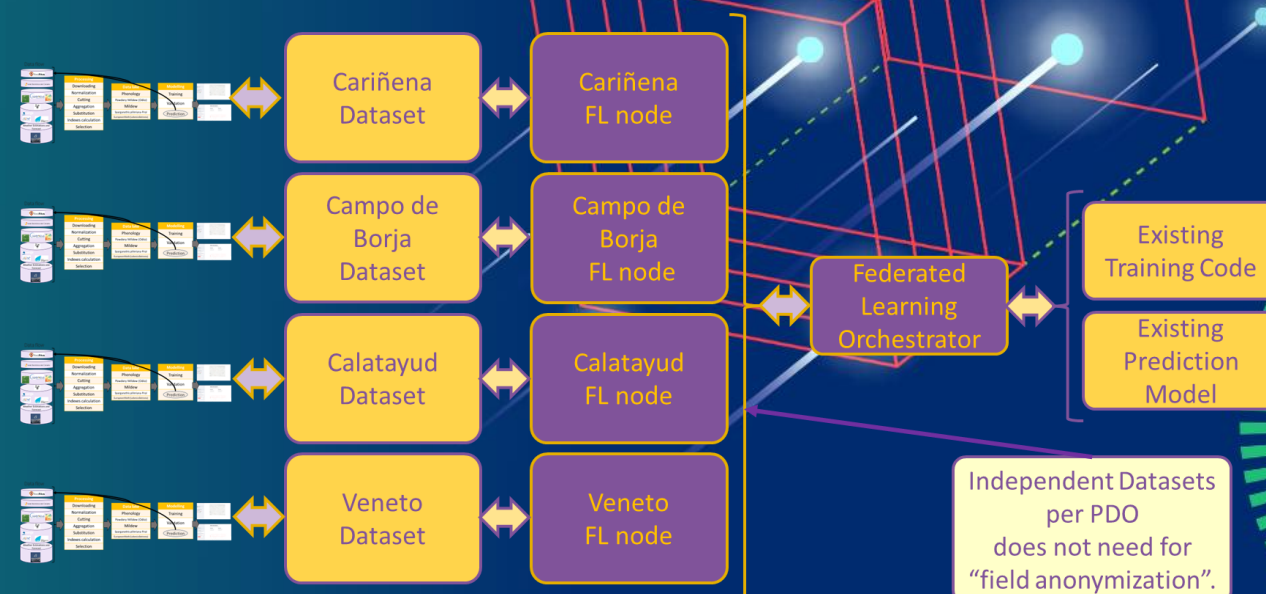
- Fusion of climatic data, Copernicus Sentinel-2 derived product data, and field observations (phenology, pests) across three PDOs: Cariñena, Campo de Borja, and Calatayud.
- Includes vineyard descriptors (geographical indication, grape variety, etc.).
- Veneto region to be included.
- Potential need for “field anonymization”.



Use Case 1

Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Propose Approach: Federated Learning (1/2)



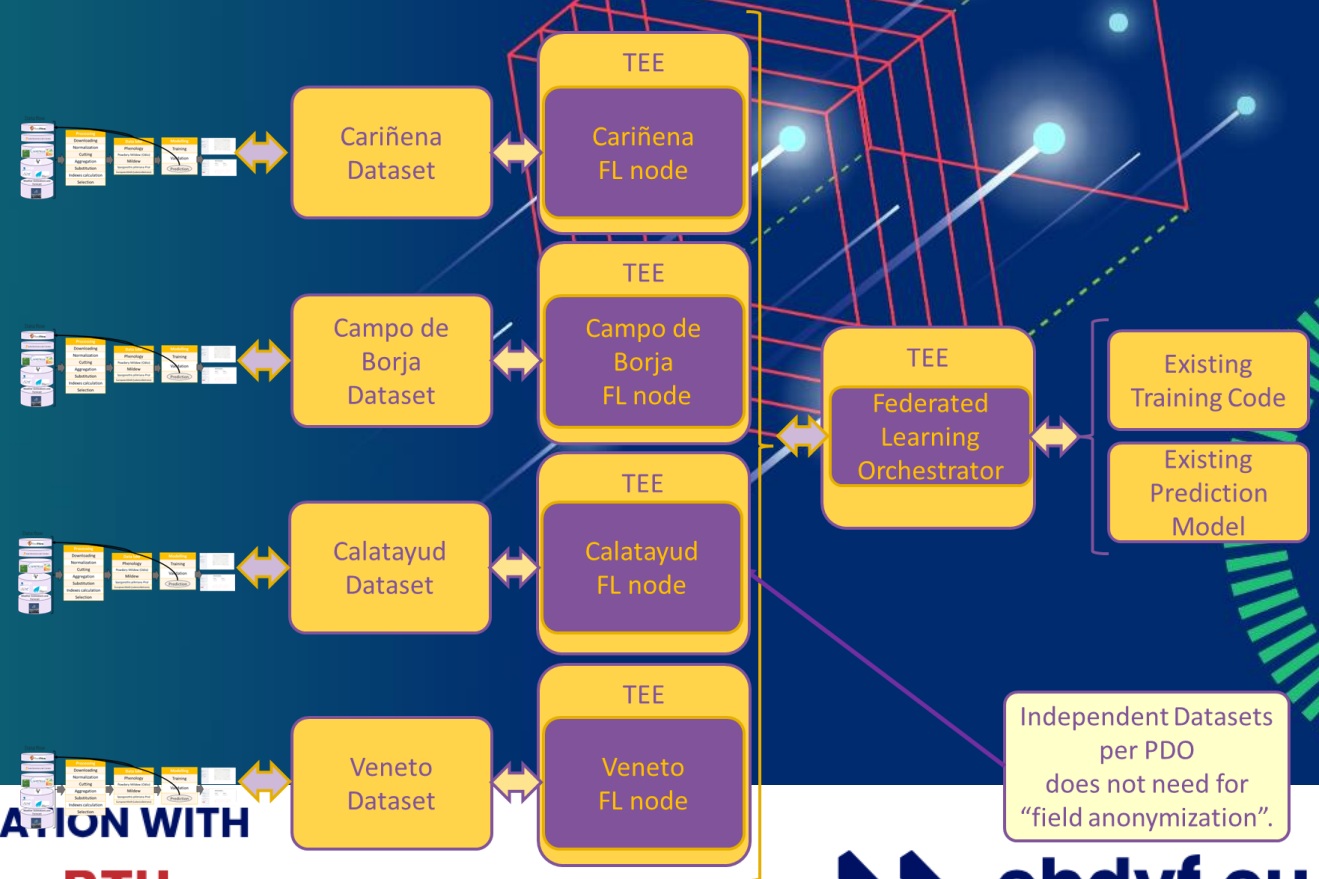
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Use Case 1

Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Propose Approach: Federated Learning (2/2)



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Use Case 1

Use Case 1: Confidential sharing and collaboration with sensitive agrifood government data.

Current Status & On-going work:

- **Status:** centralized phenology and powdery mildew ML models already available.
- **On going work:** deploying training process on FL infrastructure



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Questions?



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