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GaiaX Technical workshop

Tecnalia use cases

Gorka Zarate - DATAC

GaiaX Spain: Technical workshop
2/17/2025

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A little bit of Tecnalia

TECNALIA is the largest center of applied research and technological development in Spain, a benchmark in Europe and a member of the Basque Research and Technology Alliance. We collaborate with companies and institutions to improve their competitiveness, people's quality of life and achieve sustainable growth. We do it thanks to people who are passionate about technology and committed to building a better society.

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COMPETENCE CENTER SPAIN

As **IDSA Competence Center** and **Implementation Partner (business & technology)**, TECNALIA became the Spanish national benchmark center to promote IDS, develop new business models based on this technology, and guide companies when integrating their own data control processes.

IDSA Member, IDSA Competence Center Spain: European and national R&D projects, (pre-production) pilots, consultancy and dissemination support. Alberto Berreteaga as IDSA Ambassador and IDSA Competence Centre Coordinator. Different working groups collaboration (rulebook, architecture, certification, training, dataspace protocol…) - https://internationaldataspaces.org

Gaia-X EU, Gaia-X Hub España (Gaia-x Spain Hub) member. Jesus Maria Santamaria as Gaia-X Hub Spain CTO. Different working groups collaboration (Trust framework, architecture, Clearing Houses, Identity…) - https://www.gaiax.es

DATA SPACES BUSINESS ALLIANCE (DSBA) participant. As member of IDSA and Gaia-X.

ECLIPSE Foundation partner and **ECLIPSE Dataspace Working Group** member, https://dataspace.eclipse.org.

BAIDATA Partner - https://www.baidata.eu/en

Data Spaces Support Centre (DSSC): not partner but supporting initiatives / working groups: Governance, Technology and Business.

SIMPL: not partner but following the initiative and Community collaboration. - https://simpl-programme.ec.europa.eu

Sovity (Commercial provider) Connector as a service (CaaS) user and client (used for demos, internal testing and project support)

Huawei Boot-X (Commercial provider) alliance. Partners with Huawei EDS (Exchange Data Space), solution used to provide Data Spaces Technologies.

dataspaces@tecnalia.com
https://www.tecnalia.com/en/

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DataSpaces in European projects

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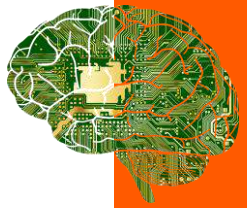
OASEES

Open Autonomous programmable cloud appS & Smart EdgE Sensors

The OASEES project aims to create a new programmability framework that will allow edge devices to work together in a decentralized and secure way, using advanced technologies such as AI/ML accelerators (FPGAs, SNNs, Quantum) and a privacy-preserving Object ID federation process. This framework will be fully open-source and developed specifically for Europe.



USE CASES

E-Health: Smart Nodes for Analysis of Voice, Articulation and Fluency Disorders in Parkison Disease

Energy: EVs fleet coordinated recharging to support optimal operation of electricity grid.

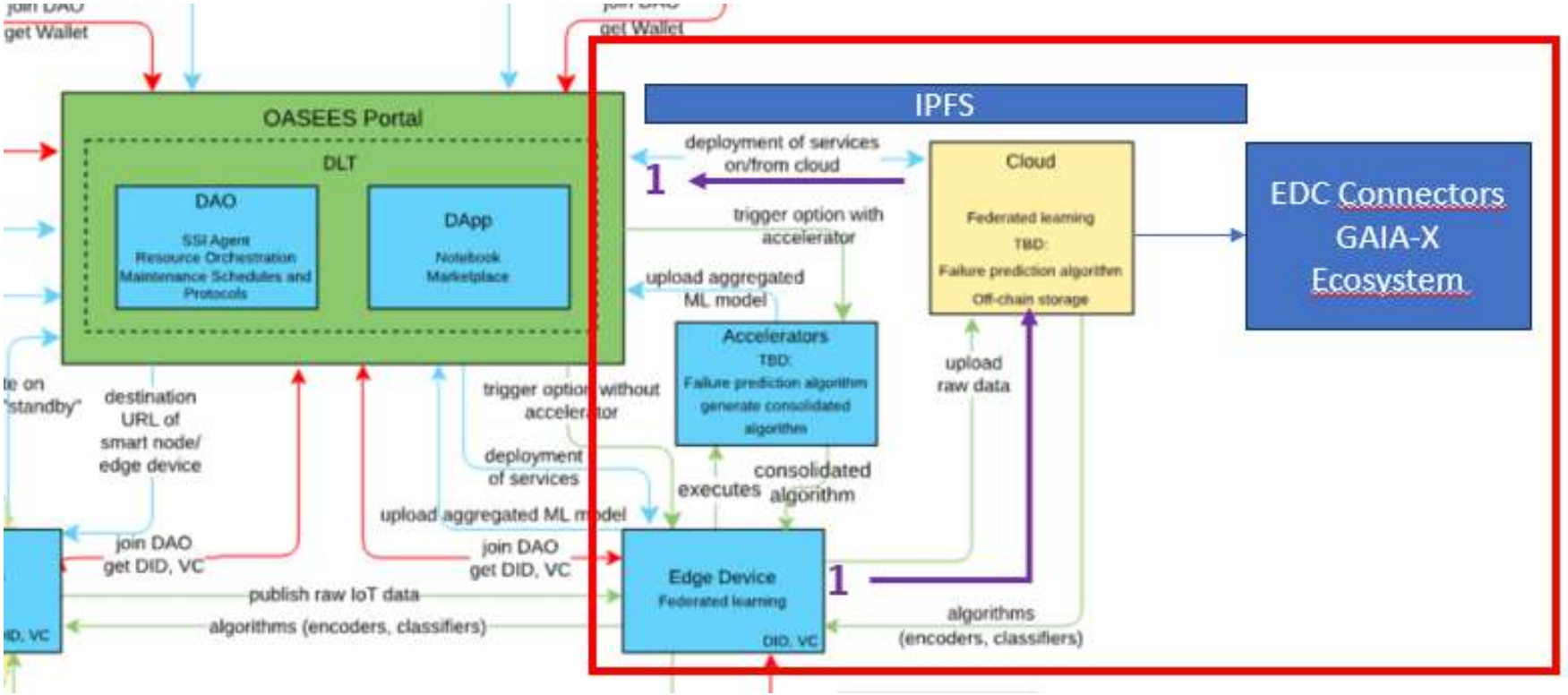
Drone Swarm for area and infrastructure inspection: Drone Swarm over 5G for High Mast Inspection.

Structural Safety for Building and Critical Infrastructure: Swarm powered intelligent Structural safety assessment for Buildings

Collaborative robotic automation: : Robotic Swarm powered Smart Factory for I4.0

Wind Energy: Smart Swarm Energy harvesting and Predictive Maintenance Wind turbines

Close view on Use case data gathering



Wind energy Data Product definition

The Data Product Canvas

Name of Data Product: **Blade Acoustic Monitoring Swarm System**

Who is the customer? **Wind Farms owners – Wind turbine Maintenance companies**

We create the data analytics solution …..

… for the following customers and users …..

Data Sources

What data sources do we need to create customer value?

Wind turbines (WT) acoustics monitoring systems: This refers to systems that monitor the acoustic characteristics of wind turbine blades. These systems collect raw acoustic data, providing insights into the sound produced by the blades during their operation.

WT blade failure and stop historic. This involves gathering information about the historical occurrences of blade failures and instances where the wind turbine had to be stopped.

WT blade maintenance plan. It outlines the schedule and procedures for maintaining and servicing the blades, ensuring optimal functionality and preventing potential failures.

Analytics

With which data analytics methods do we generate insights from the data?

Signal Processing Methods: identifying relevant features in the sound patterns failures associated with turbine performance and potential.

Neural Networks Trained by Distributed Learning Algorithms: Neural networks, a type of artificial intelligence, will be employed to recognize complex patterns in the acoustic data.

Data Product

In which form do we provide the data service to our users and customers?

Technical Reports Based on Processed Acoustic Dataset: information included in the reports consists of datetime, wind turbine id, wind turbine height and diameter, and labelled anomalies.

Wind Turbine Blades anomaly detection: Unusual patterns or anomalies in the acoustic data that can indicate issues with the blades.

Maintenance Prediction and Impact on LCOE (Levelized Cost of Energy): potential impact of maintenance activities on the Levelized Cost of Energy

Dynamic Maintenance Plan According to Blade Health Status: The data product includes a dynamic maintenance plan that adapts based on the real-time health status of the turbine blades.

Anonymized Blade Acoustic Data:

To address privacy concerns, the product includes anonymized versions of the raw acoustic data.

Customer benefits

What added value and what advantages does the data service generate to our users and services?

This data service adds value by improving turbine performance, offering non-intrusive monitoring, enabling proactive analysis and detection, ensuring algorithm reliability, evaluating maintenance cost impact, and providing anonymized data for further analysis and development.

These advantages collectively contribute to a more efficient and cost-effective management of wind turbine operations.

Pains and Gains

What wishes, problems and challenges do our customers and users have?

Wishes:

- Privacy and data protection between stakeholders (Wind Farms owners – Maintenance companies)

Problems:

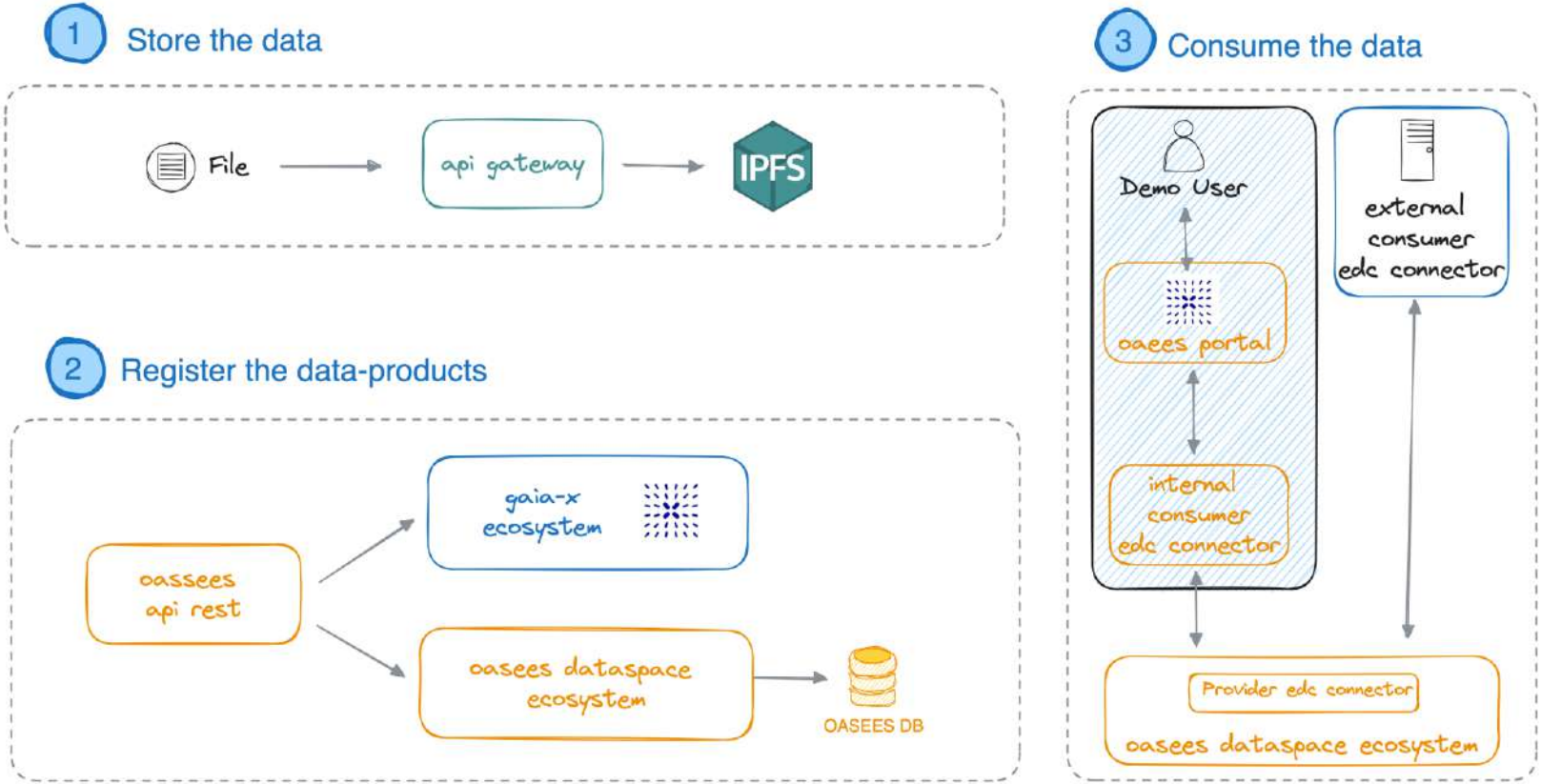
- Lack of availability, quality and veracity of the raw acoustic blade data.
- Expensive blade failure detection methods.
- Wind turbine shutdown for blade inspection.

Challenges:

-Improve Operational and Maintenance Expenditure elaborating dynamic maintenance plans.

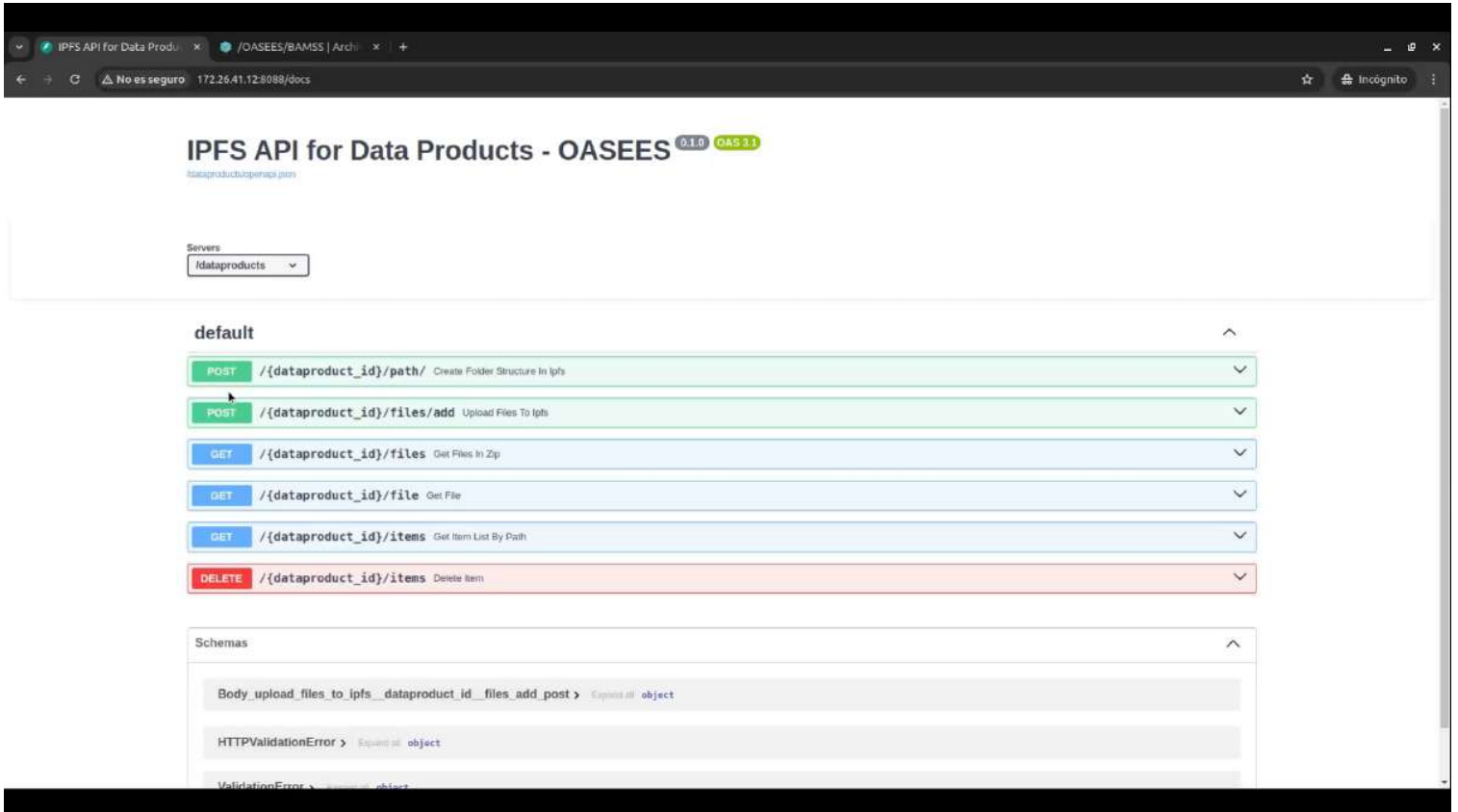
-New and innovative alternatives to diagnose blade status.

The process to make a Data Product for Gaia-X

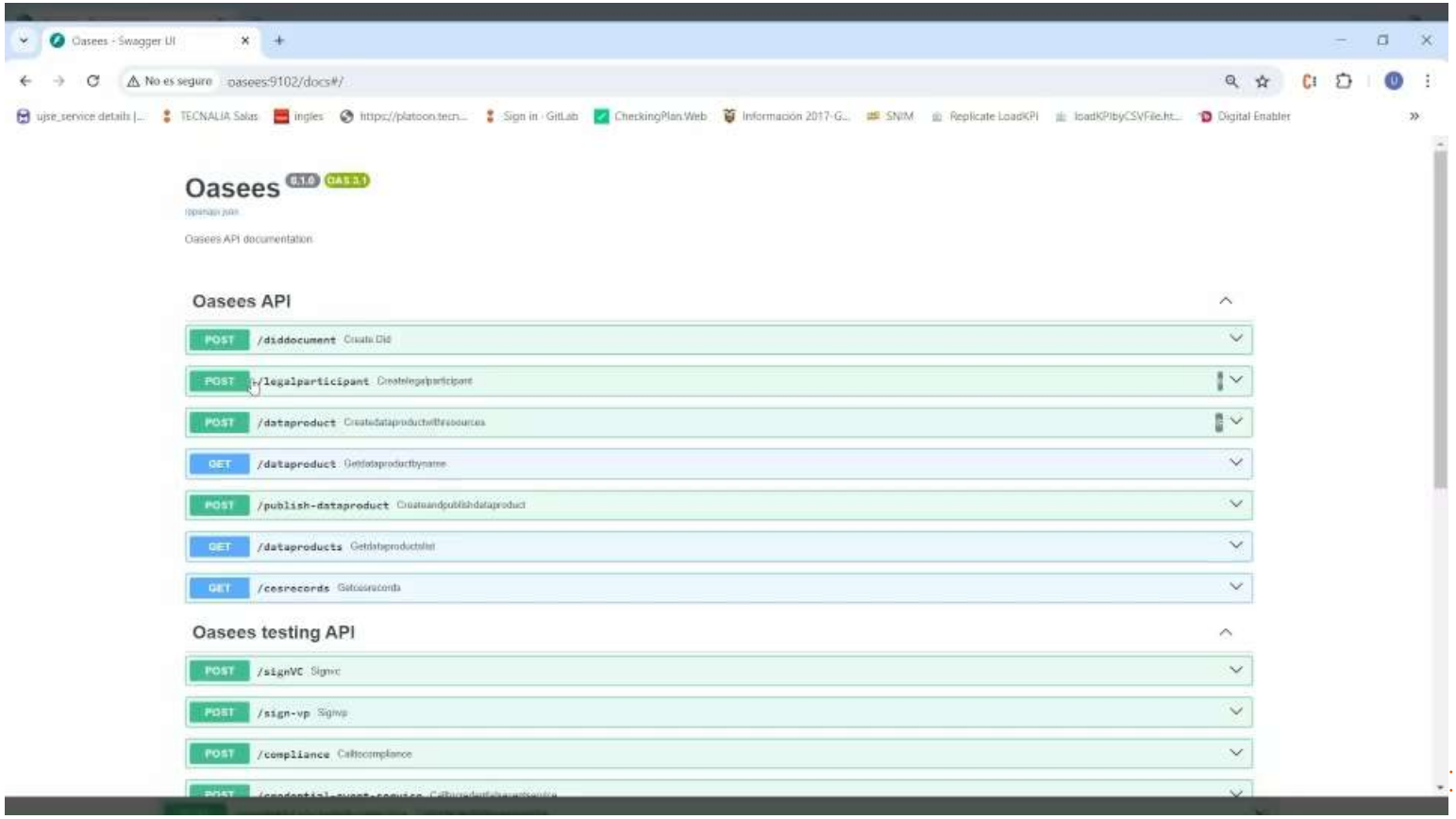


DATA PRODUCT generation (Technical Report)

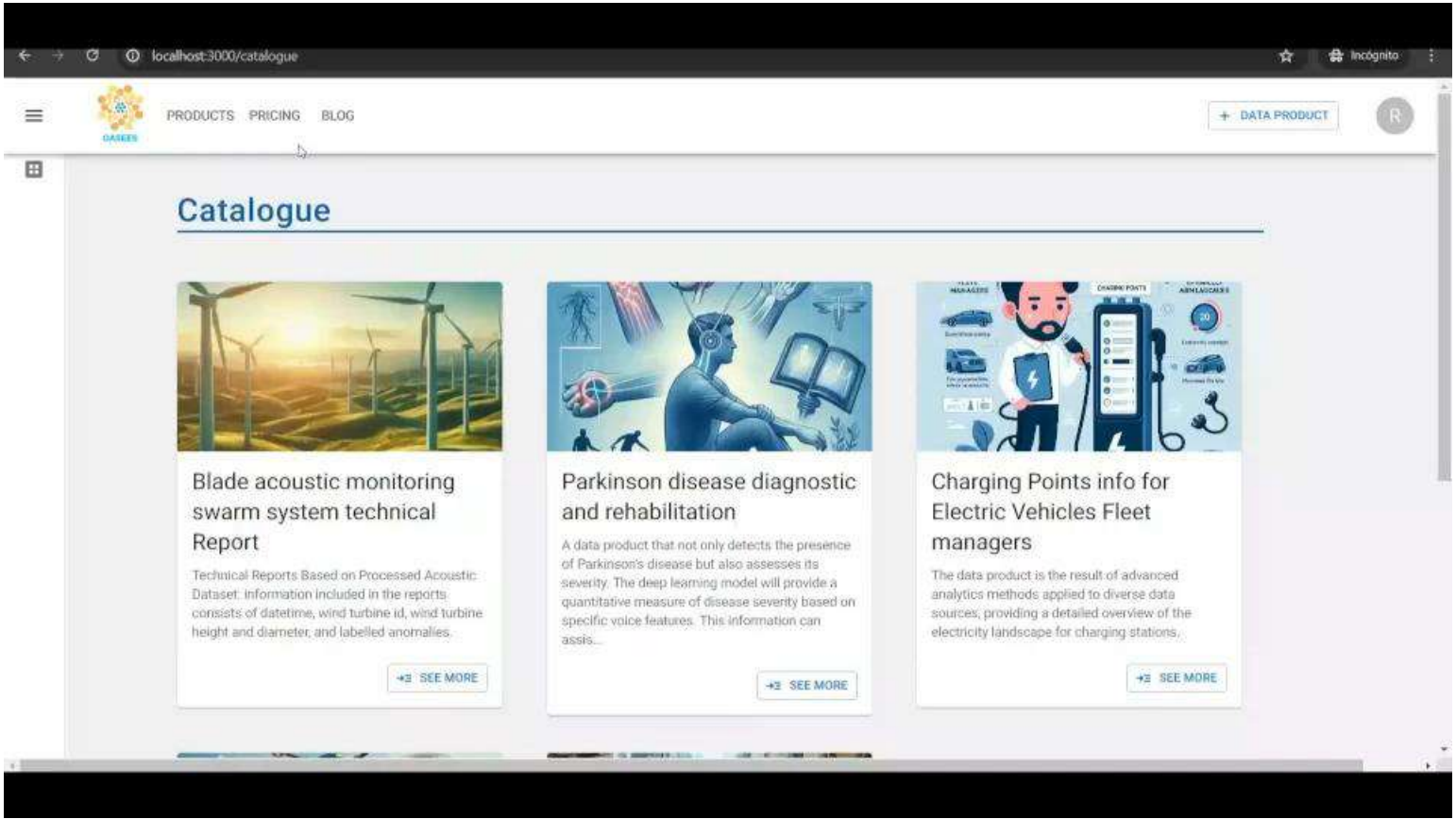
Checking that the DATA PRODUCT is stored in IPFS



Generating the Verified Credentials for the Data Product offer



Data Product consumption



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DataSpaces in real projects (Inkolan)

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Problem: Gas leak due to outdated data used for civil works

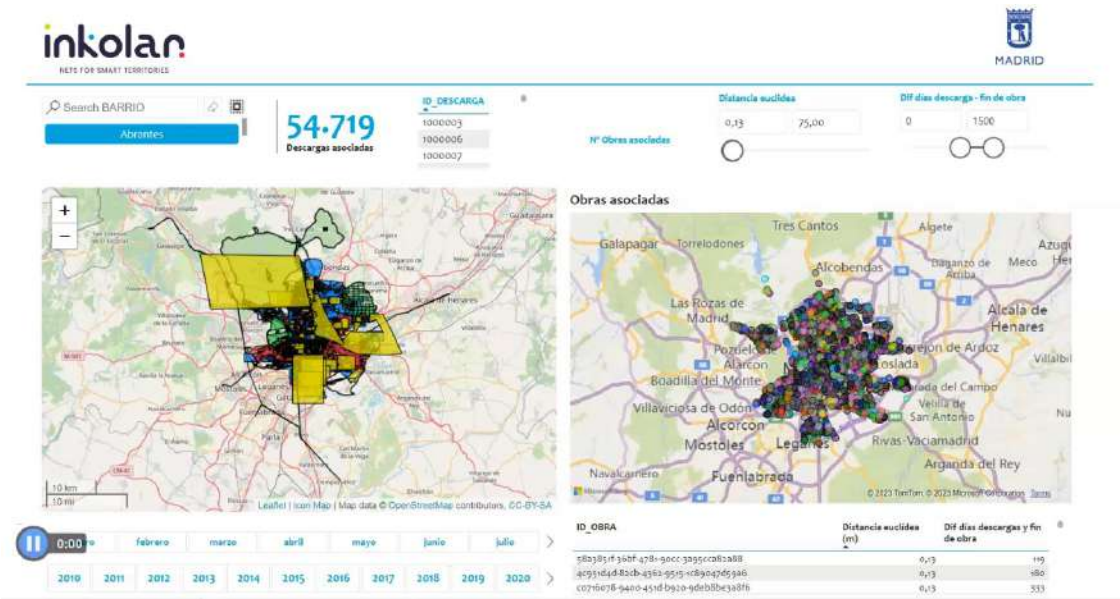
«Gas leak at the works to extend the car park at the Santiago Bernabéu stadium. According to initial reports, the leak occurred at around 8.40 am, when workers on the renovation, which is being carried out by Acciona, accidentally punctured a 20-inch diameter steel gas pipe.»

Madrid 05/22/2024.

The use of obsolete information or information not provided through INKOLAN may cause security incidents on the network, with risk to the population.

INKOLAN

Starting Business Model - Data Consumption - Madrid City Council



Once consumers select data on the INKOLAN portal, they receive a URL to download a ZIP file containing the CAD (DWG) files they have ordered.

These CAD files can then be uploaded to their GIS tools to incorporate into their maps. Once the consumer receives the URL, they can download the ZIP files as many times as they wish.

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02

Adapting business to data space

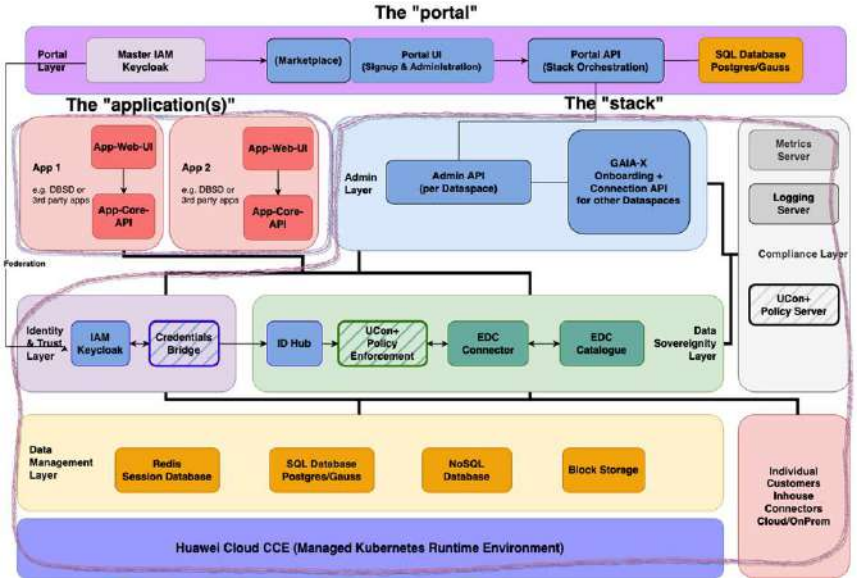
Using the BOOT-X Lighthouse

Why BOOT-X?

Boot-X is part of EDS (Exchange Data Space) and provides the infrastructure and technology needed to create a **complete data space environment** or join an existing one.

Boot-X **supports the Gaia-X Trust Framework** and provides interfaces to the GXDCH, making it easy to onboard new participants or services. It follows the EDC framework, implementing data transfer, cataloging, and identity management features. It further enhances these features with advanced identity management, policy management, and monitoring in a production-ready environment.

Boot-X is the technical enabler for **real-world use cases** and applications using data space technologies. Tecnalia and Inkolan are an example of a fully operational use case.



CASO DE NEGOCIO DE INKOLAN CON BOOT-X

Participantes Espacio de Datos

Servicio de Registro
Autoridad central del espacio de datos

Centro de Identidad
Credenciales verificables y proveedor de identidad mediante DID:web

INKOLAN (Data Broker)

Conector Espacio Datos
Negociación de contratos, inicialización transferencia de datos, supervisión

Catalogo
Publicación Datos, filtrado

Interfaz de Usuario
Acceso cómodo y gestion de recursos

Identity Hub
Credenciales verificables y proveedor de identidad mediante DID:web

Communicación a través de DSP y su especificación para peticiones al catalogo, negociación de contrato, y gestion de las transferencias (inspección)

Operador de red (Data Provider)

Conector Espacio Datos
Negociación de contratos, inicialización transferencia de datos, supervisión

Catalogo
Publicación Datos, filtrado

Interfaz de Usuario
Acceso cómodo y gestion de recursos

Identity Hub
Credenciales verificables y proveedor de identidad mediante DID:web

Ayuntamiento (Data consumer)

Conector Espacio Datos
Negociación de contratos, inicialización transferencia de datos, supervisión

Catalogo
Publicación Datos, filtrado

Interfaz de Usuario
Acceso cómodo y gestion de recursos

Identity Hub
Credenciales verificables y proveedor de identidad mediante DID:web

CASO DE NEGOCIO DE INKOLAN CON BOOT-X

Espacio de Datos- Proceso

Servicio de Registro
Autoridad central del espacio de datos

Centro de Identidad
Credenciales verificables y proveedor de identidad mediante DID:web

INKOLAN

- Proporciona el formulario de aplicación web
- Procesos de aplicación actualizados para activar el backend del espacio de datos
- Define las políticas para el conjunto de datos (bundles)
- Persiste los acuerdos contractuales
- Registro y supervisión
- Procesa los datos obtenidos de las utilidades y genera archivos KML
- Mejor control del uso de los datos salientes
- Infraestructura reutilizable para futuros casos o actualizaciones en las políticas

- Inicia la aplicación como siempre
- Se autentica con la identidad del espacio de datos (CV diferente de Utilidad)
- Solicitud de datos (por ejemplo, seleccionar rango, añadir capa) mediante el formulario de la aplicación Web.
- Desde el visor SIG, cuando se solicita KML se da la uri del conector
- Si se concede el acceso y se acuerdan las políticas, los datos se transfieren al visor del GIS y se muestran en el mapa.

Ficheros (KML)
Keyhold Markup Language

Operador de red

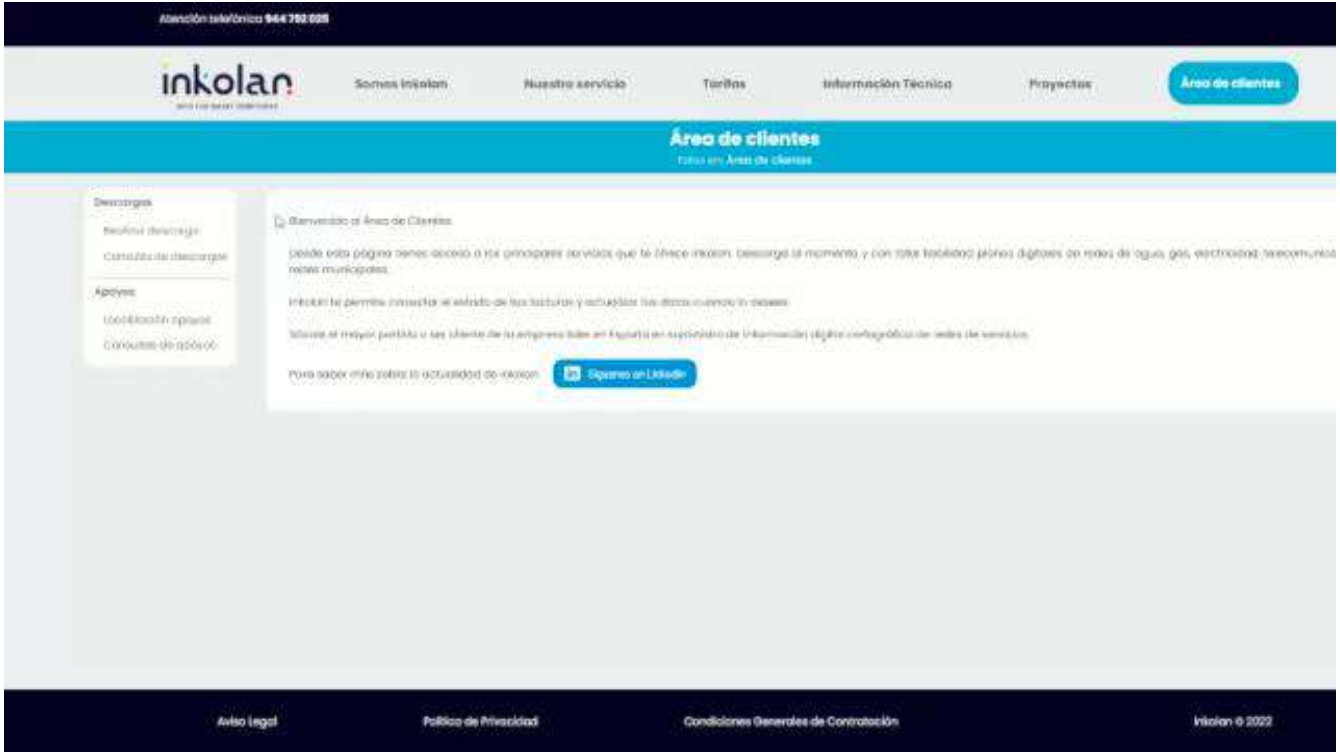
- Carga el archivo en OBS (en el futuro será a través de FTP/otro)
- Se autentica con la identidad del espacio de datos (VC)
- La petición de los datos acciona la petición vía conector del dataspace
- Contratos persistentes como prueba
- Seguimiento de los intercambios de datos con fines de auditoría. Información proporcionada a través de un panel de control

Ayuntamiento

La UX se proporciona en la misma plataforma GIS en la que se gestionan otros datos espaciales (por ejemplo, abiertos (Datos gubernamentales: qué son los datos abiertos | data.europa.eu) para proporcionar contexto a la información ofrecida por INKOLAN (privada y segura, relacionada con infraestructuras críticas...) y se tratan conjuntamente como Espacios Comunes de Datos Europeos | Shaping Europe's digital future (europa.eu)

INKOLAN Data Space - Demo

From Data Providers (Network Operator) to Data Consumers (Municipalities)



DASHBOARD for metrics

A dashboard has been developed to obtain real-time metrics of all transactions carried out within the data space so that this information can be used for **AUDITS**.

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03

KATEA DATA SPACE (TECNALIA)

KATEA Research Cloud (KRC)

Where digital projects are built

openstack.

RED HAT® OPENSHIFT Container Platform

Máquinas Virtuales

Contenedores

SDN

Almacenamiento

Seguridad

API

KATEA Compute Platform (KCP)

When processing power is required

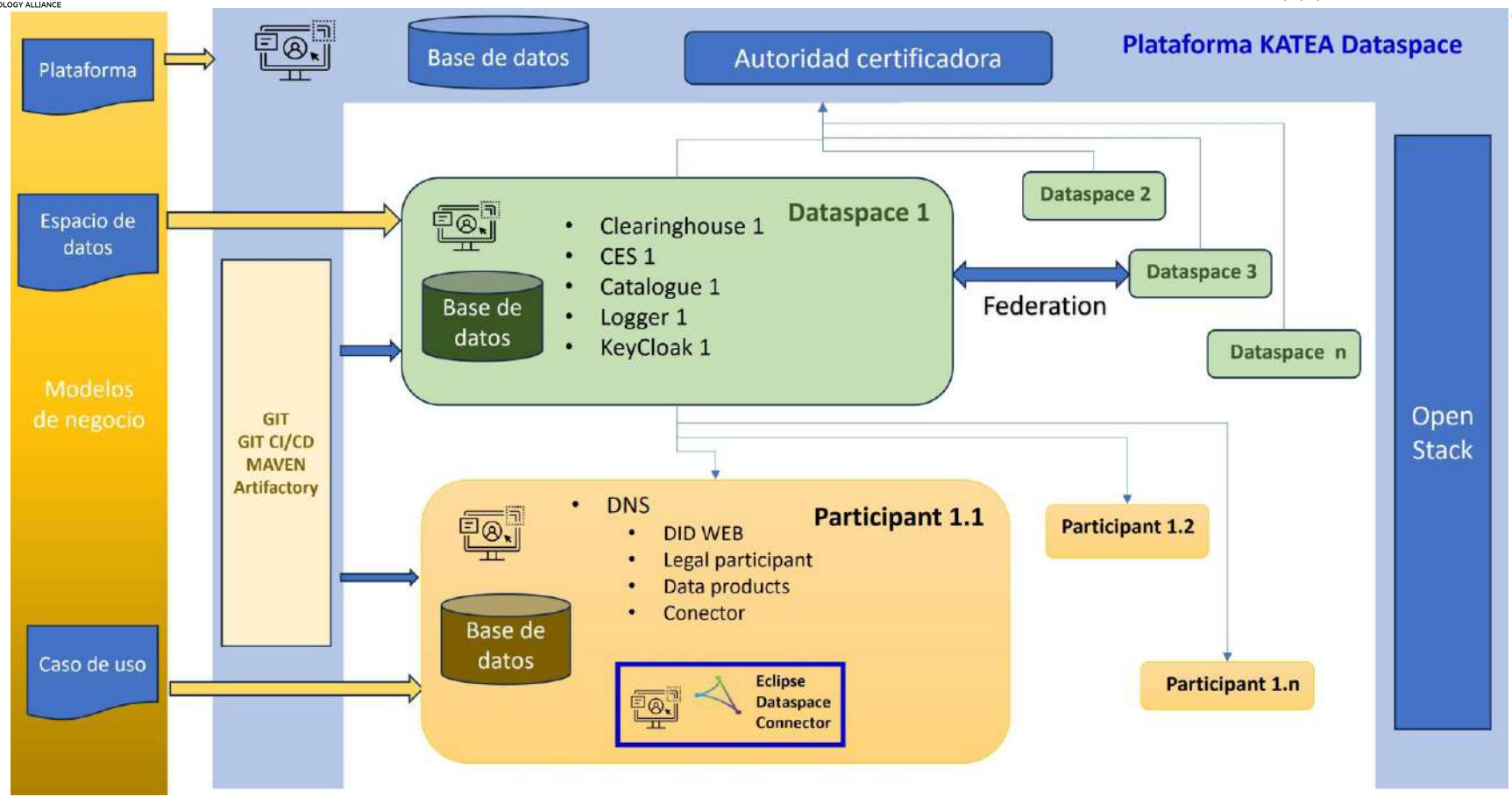
KCP, primer centro de super computación de KATEA ubicado en Mikeletegi 2 (Donostia)

Specs:

- **CPU**: 1120 cores a 3,8GHz
- **RAM**: 11 TB
- **Storage**: ~ 1 Petabyte
- **GPU**:
  - 5 x Nvidia A100 80GB
  - 6 x Nvidia H100 80GB
  - 8 x Nvidia H100 SXM 80GB

Potencia bruta:

- **CPU** – 85.555,2 Gflops
- **GPU –** 977,5 Teraflops


Plataforma
Espacio de datos
Modelos de negocio
Caso de uso
GIT
GIT CI/CD
MAVEN
Artifactory
Base de datos
Autoridad certificadora
Plataforma KATEA Dataspace
Dataspace 1
Clearinghouse 1
CES 1
Catalogue 1
Logger 1
KeyCloak 1
Base de datos
Federation
Dataspace 2
Dataspace 3
Dataspace n
Participant 1.1
DNS
DID WEB
Legal participant
Data products
Conector
Base de datos
Eclipse Dataspace Connector
Participant 1.2
Participant 1.n
Open Stack

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Espacio de Datos: “Urban Data Sharing”

Ecosistema para la compartición de datos de infraestructuras

Gaia-X Hub España Summit
4/12/2024

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Descripción del modelo de negocio

Enfoque actual del intercambio de datos urbanos

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Datos para la ciudad del mañana según el World Economic Forum

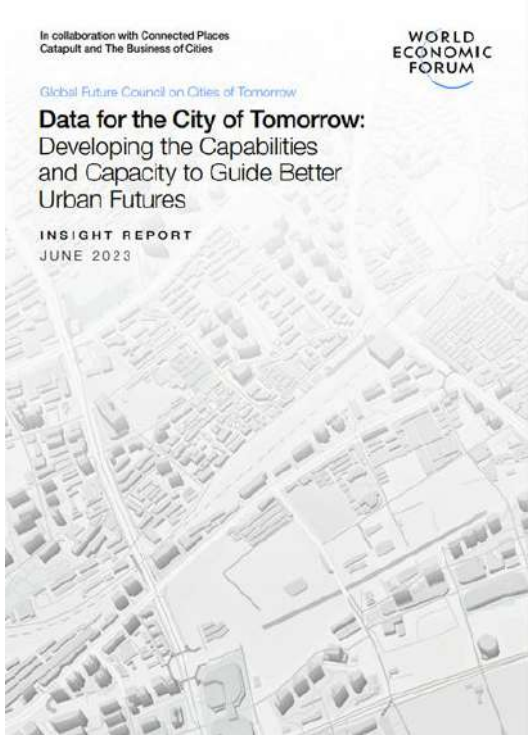

TABLE 1 The challenges holding back the application of data to city-making and management[10]

Problem and need	Limited data availability	Definitions and coherence issues	Few agreed standards
The problem	In many parts of the world, especially in lower-income cities and regions, the reservoir of public, private and civic data from which to draw is still modest.	No accepted universal definition yet exists for what constitutes a city, where cities stop, or what defines liveability, smartness or prosperity.	Efforts to standardize city indicators and data-collection processes[11] are still at an early stage and are not uncontested. Data is also hard to interpret in a vacuum and translate into policy decisions.
What cities need	– Better data planning – Stronger digital infrastructure – More reliable or pooled resources – Incentives for data to spread to new places	– More clarity on "what success looks like" – More "like-for-like" data across diverse cities or contexts	– An agreed consensus on what data matters, for what and for whom – Advice to navigate the many data choices available
	Lack of skills and capacity	**Governance and processes issues**	**Lack of trust**
The problem	The collection of data, the development of accurate models and the preparation of information for decision-makers and residents rely on strong local capability and a culture of valuing this activity.	Only some cities have data strategies, chief data or technology officers, or enjoy strategic partnerships with data service providers.	Citizens do not always trust their local government or city with their data. They may also not fully understand how data is being used, especially with enhanced data sets (like digital twins).
What cities need	– Funds and structures to recruit the skills required – Strong technical and communication systems to maximize the value of data	– Credible governance and systems to organize data around problems – Tools to combine public- and private-sector information – Tried-and-tested arrangements for durable partnerships and responsible co-ownership	– Improved dialogue with citizens about the security and use of their data – Clear data policies and communication on the benefits data use will deliver to people and businesses and will contribute to sustainability – Local and international media to popularize good data for cities

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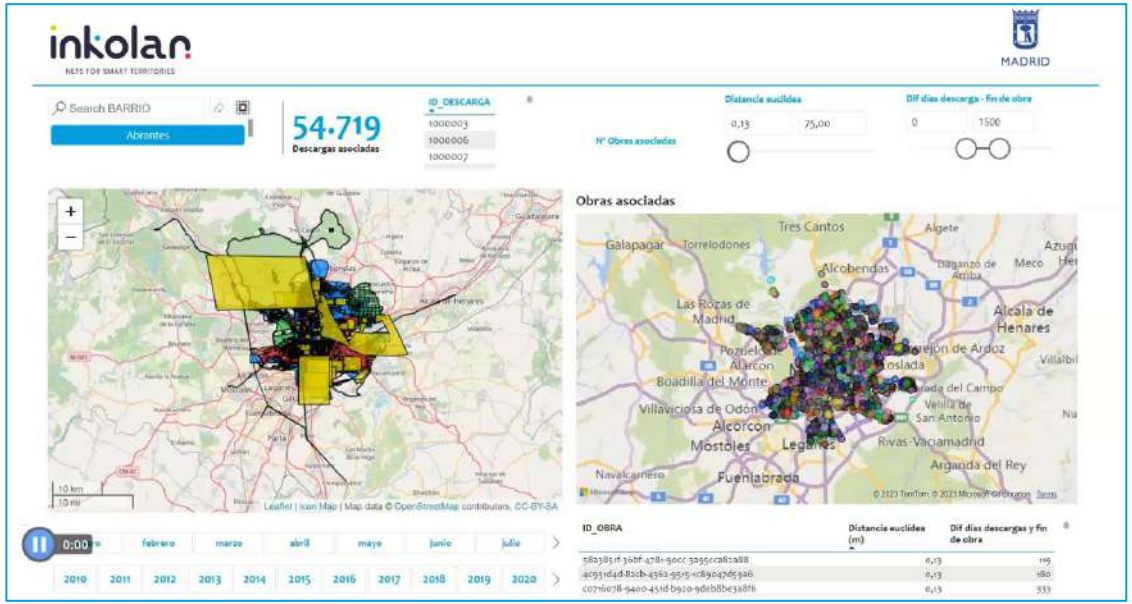
Modelo de Negocio

INKOLAN

Modelo de Negocio- Consumo de Datos- Ayuntamiento de Madrid



Una vez que los consumidores seleccionan los datos en el portal INKOLAN, reciben una URL para descargar un archivo ZIP que contiene los archivos CAD (DWG) que han pedido.

Estos archivos CAD pueden cargarse en sus herramientas GIS para incorporarlos a sus mapas.

Una vez que el consumidor recibe la URL, puede descargar los archivos ZIP tantas veces como desee.

RIESGOS INHERENTES AL SUMINISTRO DE DATOS GIS

Fuga de gas debido a los datos no actualizados utilizados para obra civil

«Fuga de gas en las obras de ampliación del aparcamiento del estadio Santiago Bernabéu. Según las primeras informaciones, la fuga se produjo en torno a las 8.40 horas, cuando los trabajadores de la reforma, que está llevando a cabo Acciona, pincharon por error una tubería de gas de acero de 20 pulgadas de diámetro.» Madrid 22/05/2024.

El uso de información obsoleta o no facilitada a través de INKOLAN, puede originar incidentes de seguridad en la red, con riesgo para la población.

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02

Adaptación del negocio a Espacio de Datos

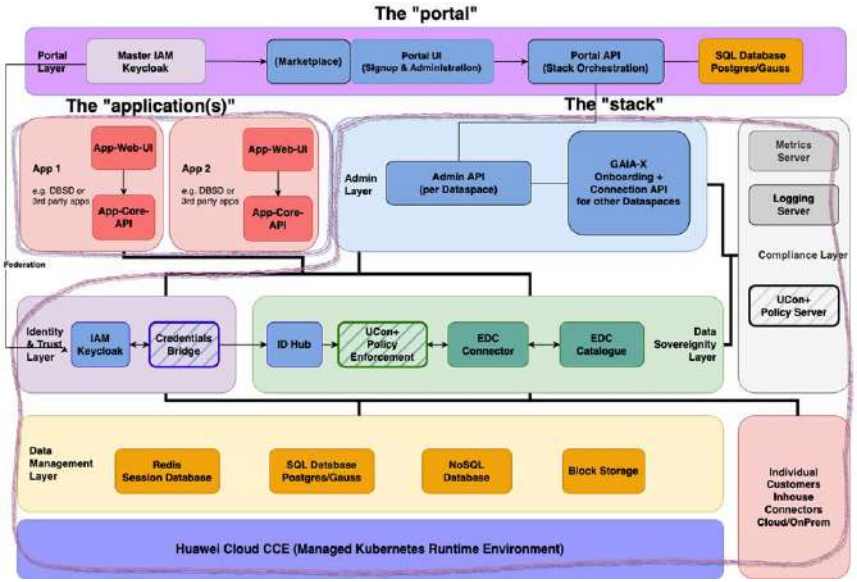
Utilización del Lighthouse BOOT-X

¿Porqué BOOT-X?

Boot-X forma parte de EDS (Exchange Data Space) y proporciona la infraestructura y la tecnología necesarias para crear **un entorno de espacio de datos completo** o unirse a uno ya existente.

Boot-X es **compatible con el marco de confianza de Gaia-X** y ofrece interfaces para el GXDCH, lo que facilita la incorporación de nuevos participantes o servicios. Sigue el marco EDC, implementando funciones de transferencia de datos, catalogación y gestión de identidades. Además, mejora estas funciones con gestión avanzada de identidades, gestión de políticas y supervisión en un entorno listo para la producción.

Boot-X es el habilitador técnico para **casos de uso y aplicaciones del mundo real** que utilizan tecnologías de espacio de datos. **Tecnalia e Inkolan** es un ejemplo de un **caso de uso plenamente operativo**



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Catalogo
Publicación Datos, filtrado

Interfaz de Usuario
Acceso cómodo y gestion de recursos

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Credenciales verificables y proveedor de identidad mediante DID:web

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Negociación de contratos, inicialización transferencia de datos, supervisión

Catalogo
Publicación Datos, filtrado

Interfaz de Usuario
Acceso cómodo y gestion de recursos

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Credenciales verificables y proveedor de identidad mediante DID:web

Communicación
a través de DSP
y su especificación
para peticiones al catalogo,
negociación de contrato,
y gestion de las transferencias
(inspección)

Ayuntamiento (Data consumer)

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Ficheros (KML)
Keyhold Markup Language

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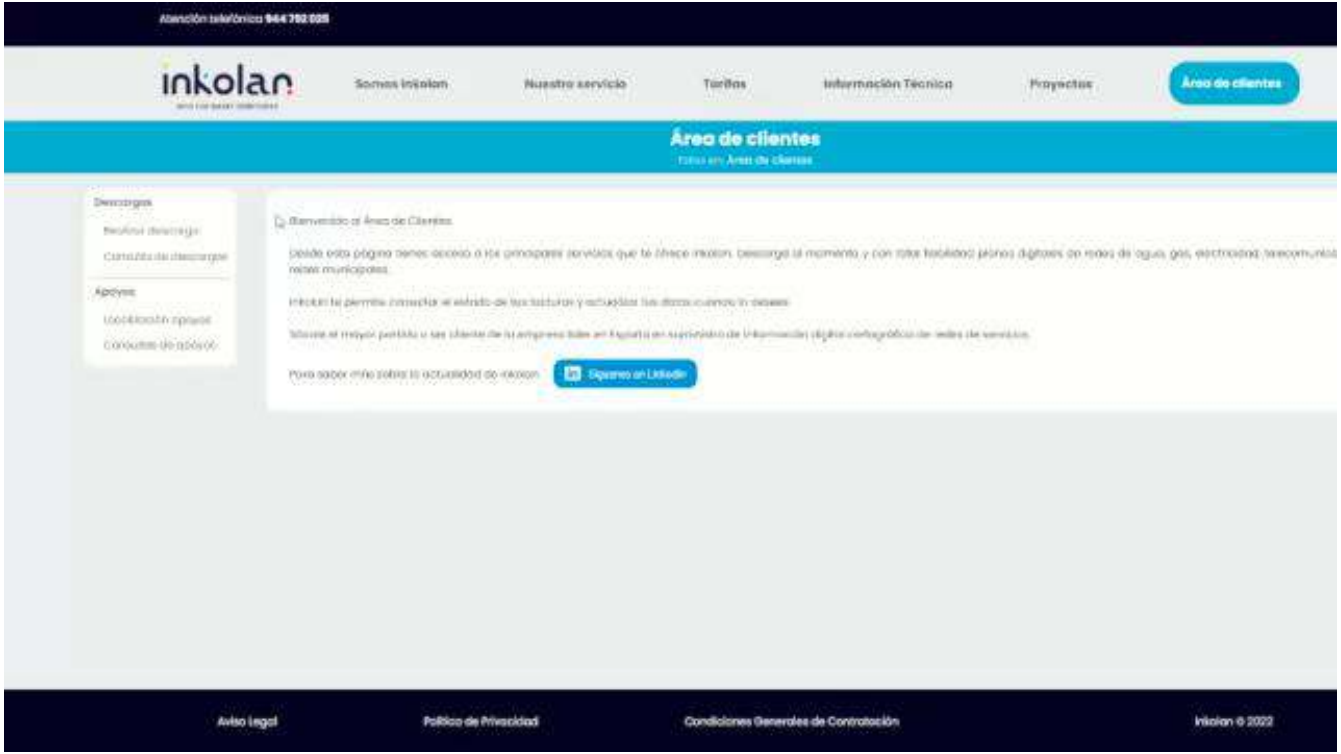
Espacio de Datos de INKOLAN - Demo

Desde los Proveedores de Datos (Operador de Red a los Consumidores de Datos (Ayuntamientos)



DASHBOARD para métricas

Se ha desarrollado un panel para obtener métricas en tiempo real de todas las transacciones que se realizan dentro del espacio de datos de forma que esta información se pueda usar para AUDITORIAS.


tech-x
TECH-X Conference &
HACKATHON #7
23 & 24 May 2024
Luxembourg
in partnership with gaia-x
Hub Luxembourg
#GaiaX #TechX24

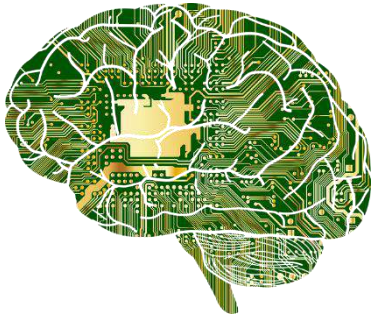
tech-x

How to make a data product for Gaia-X

Jesús María Santamaría
CTO Digital Unit, Tecnalia Research & Innovation

#GaiaX #TechX24

Context: OASEES Horizon Europe project



OASEES

Open Autonomous programmable cloud appS & Smart EdgE Sensors

The OASEES project aims to create a new programmability framework that will allow edge devices to work together in a decentralized and secure way, using advanced technologies such as AI/ML accelerators (FPGAs, SNNs, Quantum) and a privacy-preserving Object ID federation process. This framework will be fully open-source and developed specifically for Europe.

USE CASES

E-Health: Smart Nodes for Analysis of Voice, Articulation and Fluency Disorders in Parkison Disease

Energy: EVs fleet coordinated recharging to support optimal operation of electricity grid.

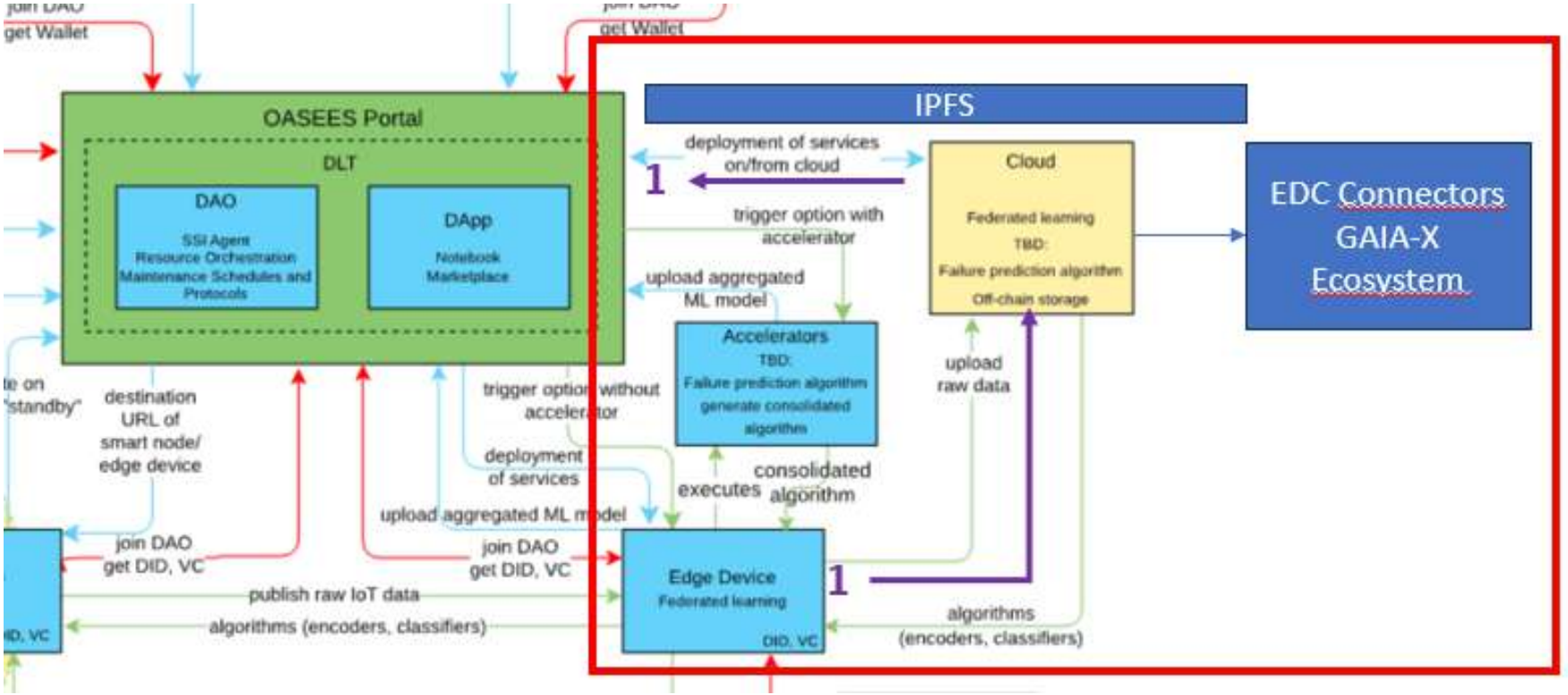
Drone Swarm for area and infrastructure inspection: Drone Swarm over 5G for High Mast Inspection.

Structural Safety for Building and Critical Infrastructure: Swarm powered intelligent Structural safety assessment for Buildings

Collaborative robotic automation: : Robotic Swarm powered Smart Factory for I4.0

Wind Energy: Smart Swarm Energy harvesting and Predictive Maintenance Wind turbines

Close view on Use case data gathering



Wind energy Data Product definition

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The Data Product Canvas

Name of Data Product: **Blade Acoustic Monitoring Swarm System**

Who is the customer? **Wind Farms owners – Wind turbine Maintenance companies**

We create the data analytics solution …..

… for the following customers and users …..

Data Sources

What data sources do we need to create customer value?

Wind turbines (WT) acoustics monitoring systems: This refers to systems that monitor the acoustic characteristics of wind turbine blades. These systems collect raw acoustic data, providing insights into the sound produced by the blades during their operation.

WT blade failure and stop historic. This involves gathering information about the historical occurrences of blade failures and instances where the wind turbine had to be stopped.

WT blade maintenance plan. It outlines the schedule and procedures for maintaining and servicing the blades, ensuring optimal functionality and preventing potential failures.

Analytics

With which data analytics methods do we generate insights from the data?

Signal Processing Methods: identifying relevant features in the sound patterns failures associated with turbine performance and potential.

Neural Networks Trained by Distributed Learning Algorithms: Neural networks, a type of artificial intelligence, will be employed to recognize complex patterns in the acoustic data.

Data Product

In which form do we provide the data service to our users and customers?

Technical Reports Based on Processed Acoustic Dataset: information included in the reports consists of datetime, wind turbine id, wind turbine height and diameter, and labelled anomalies.

Wind Turbine Blades anomaly detection: Unusual patterns or anomalies in the acoustic data that can indicate issues with the blades.

Maintenance Prediction and Impact on LCOE (Levelized Cost of Energy): potential impact of maintenance activities on the Levelized Cost of Energy

Dynamic Maintenance Plan According to Blade Health Status: The data product includes a dynamic maintenance plan that adapts based on the real-time health status of the turbine blades.

Anonymized Blade Acoustic Data: To address privacy concerns, the product includes anonymized versions of the raw acoustic data.

Customer benefits

What added value and what advantages does the data service generate to our users and services?

This data service adds value by improving turbine performance, offering non-intrusive monitoring, enabling proactive analysis and detection, ensuring algorithm reliability, evaluating maintenance cost impact, and providing anonymized data for further analysis and development.

These advantages collectively contribute to a more efficient and cost-effective management of wind turbine operations.

Pains and Gains

What wishes, problems and challenges do our customers and users have?

Wishes:

- Privacy and data protection between stakeholders (Wind Farms owners – Maintenance companies)

Problems:

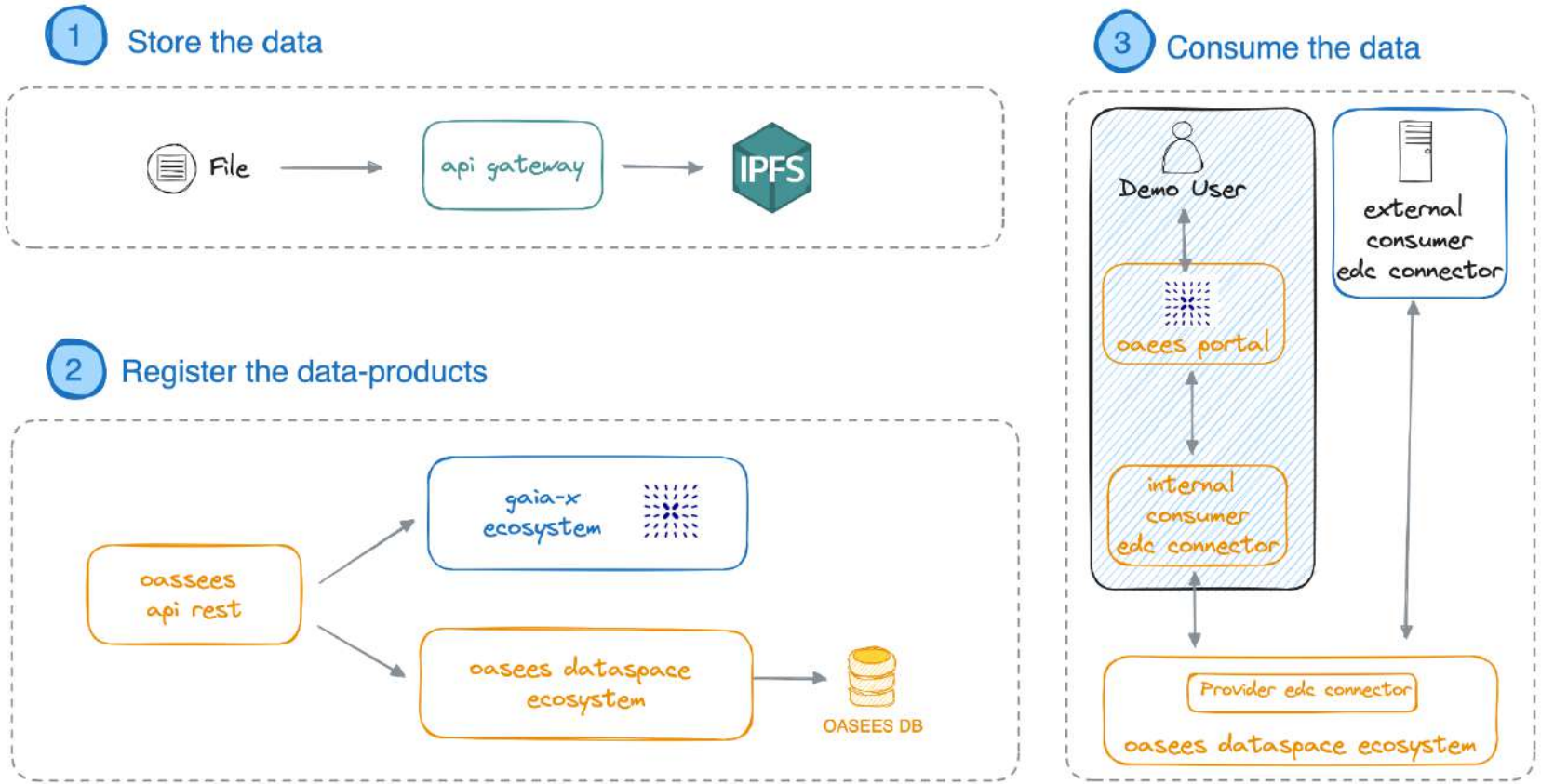
- Lack of availability, quality and veracity of the raw acoustic blade data.
- Expensive blade failure detection methods.
- Wind turbine shutdown for blade inspection.

Challenges:

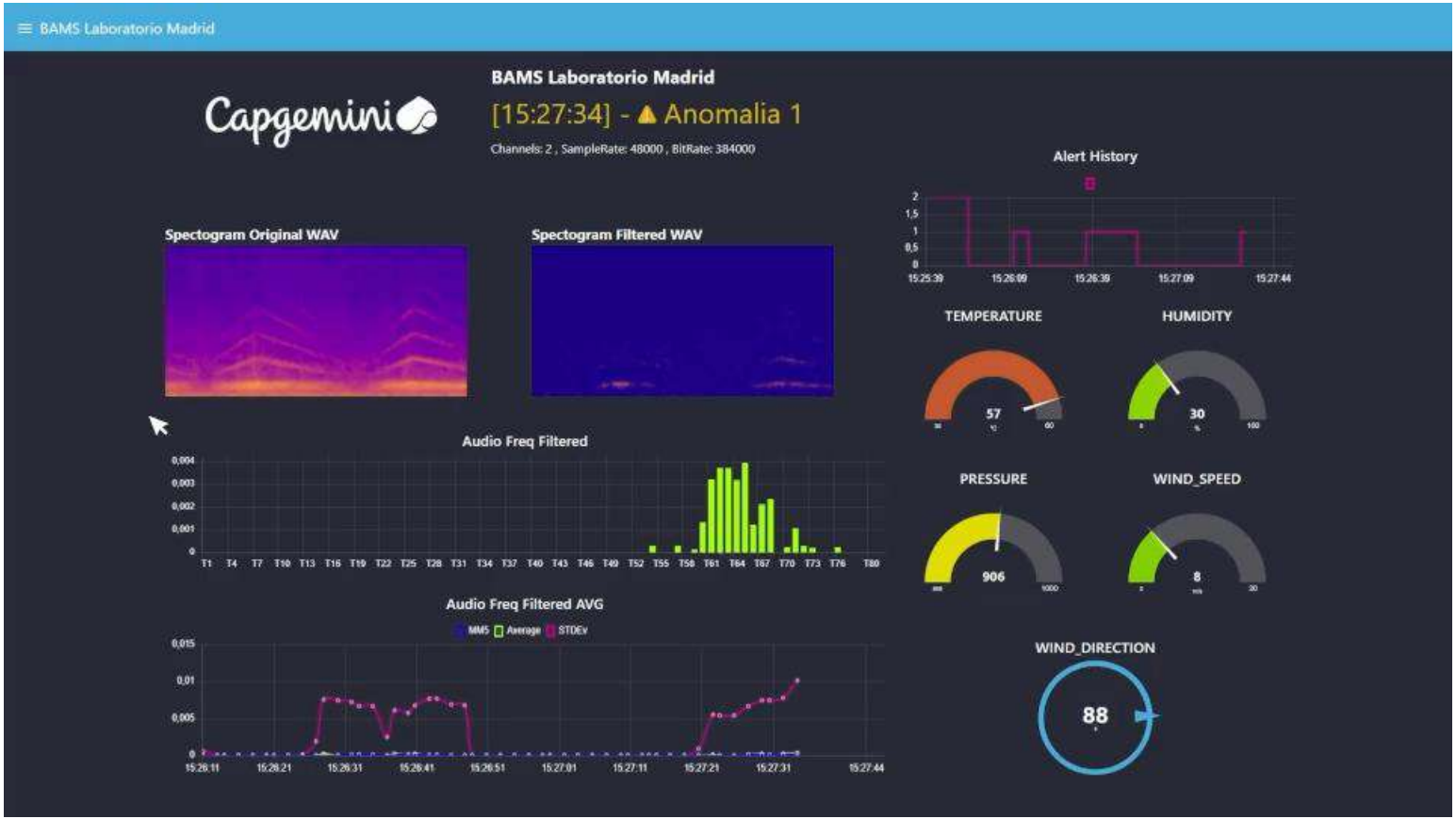
-Improve Operational and Maintenance Expenditure elaborating dynamic maintenance plans.

-New and innovative alternatives to diagnose blade status.

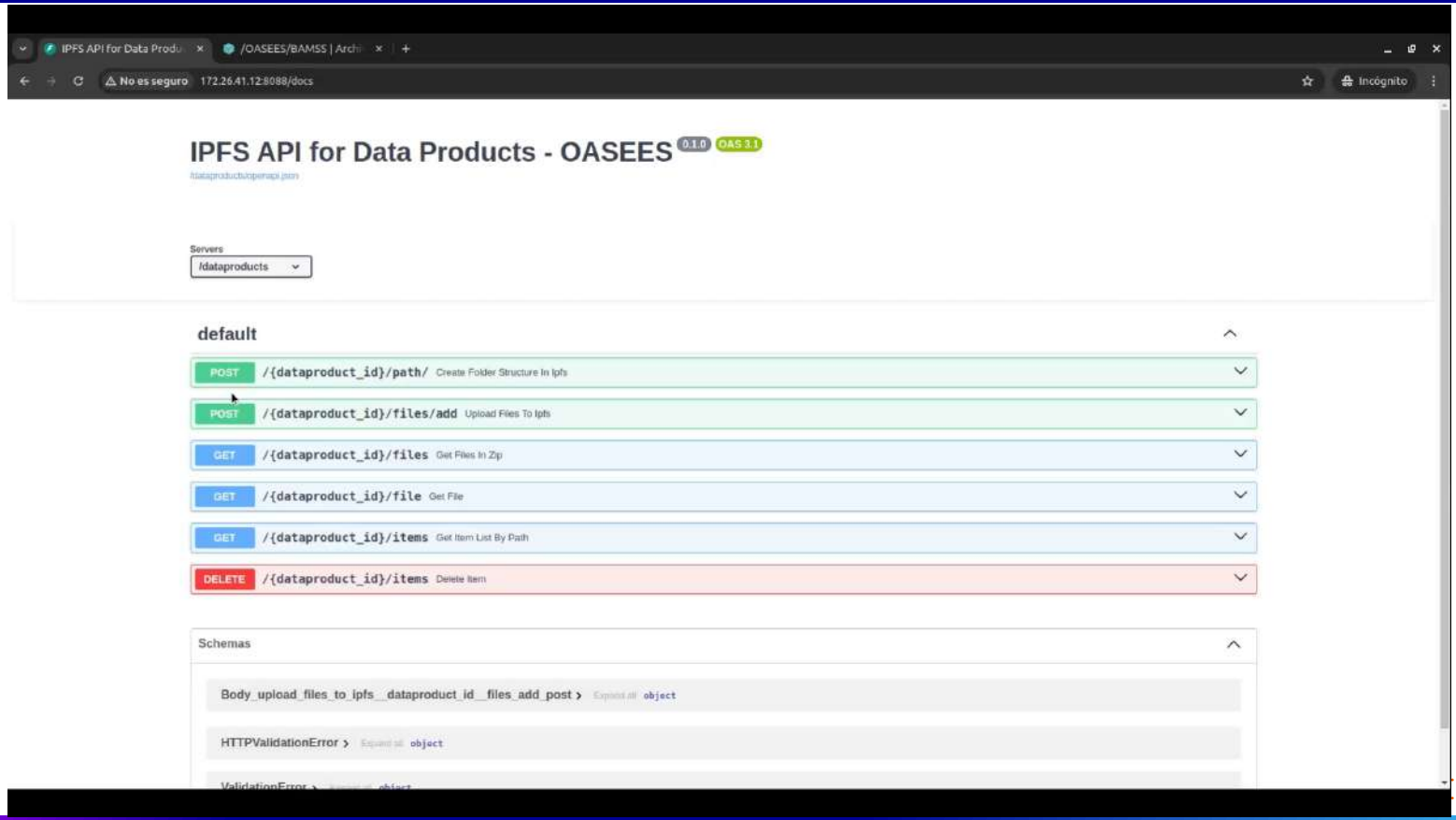
The process to make a Data Product for Gaia-X



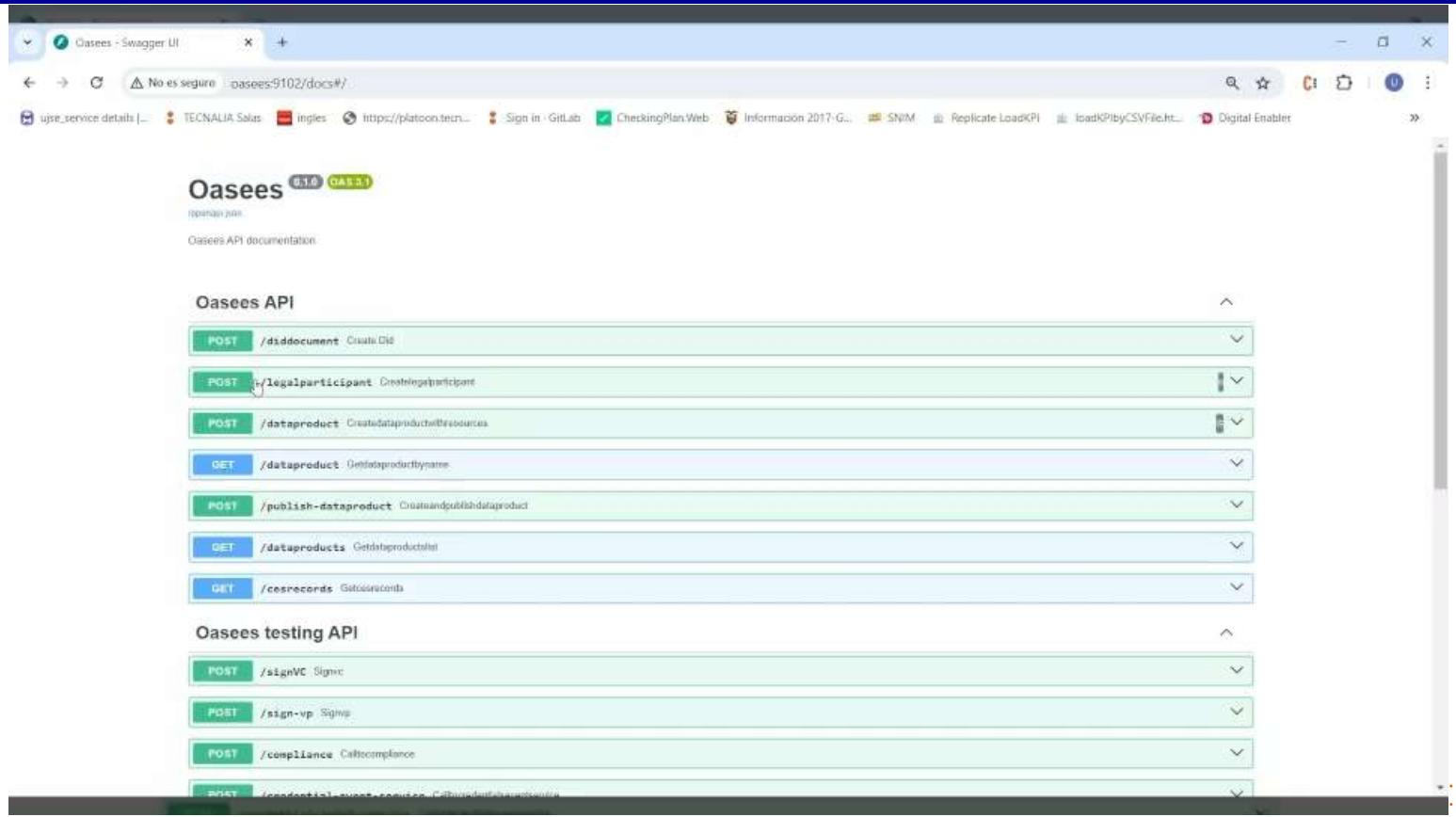
DATA PRODUCT generation (Technical Report)



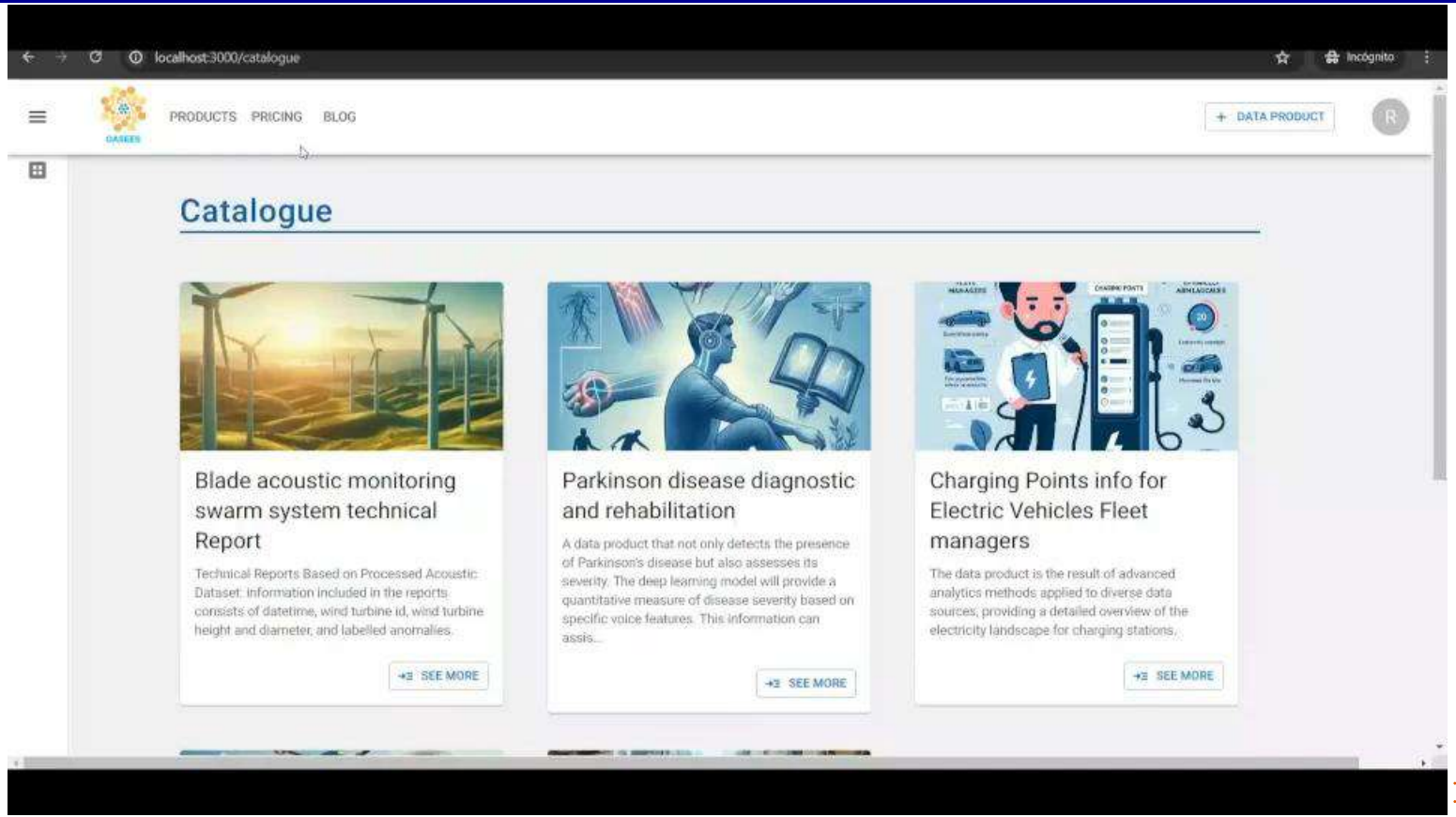
Checking that the DATA PRODUCT is stored in IPFS



Generating the Verified Credentials for the Data Product offer



Data Product consumption



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Thank you!

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