coppilot

D2.1

ECOSYSTEM DEFINITION AND REQUIREMENTS

Report on the ecosystem requirements, including initial platform design, UC requirements, and stakeholders.

Revision: v2.0

D2.1: Ecosystem definition and requirements

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Abstract	The COP-PILOT platform is an open collaborative system for managing services across IoT, edge and core computing environments. COP-PILOT is built to enable secure and intelligent operations that connect diverse sectors. This document brings together an ecosystem of technical blueprints and services models across 5 main domains to support the development of these infrastructures. With a focus on seamless cross domain integration, it lays the foundation for private edge deployments and digital ecosystems across Europe. This deliverable sets the direction for building a platform that drives smarter, more secure, and collaborative digital transformations across multiple industries.
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PU	Public, fully open, e.g. web (Deliverables flagged as public will be automatically published in CORDIS project's page)	X
SEN	Sensitive, limited under the conditions of the Grant Agreement	
Classified R-UE/ EU-R	*EU RESTRICTED under the Commission Decision No2015/ 444*	
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* R: Document, report (excluding the periodic and final reports)

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

DATA: Data sets, microdata etc.

DMP: Data management plan

ETHICS: Deliverables related to ethics issues.

SECURITY: Deliverables related to security issues

OTHER: Software, technical diagram, algorithms, models, etc.

EXECUTIVE SUMMARY

In this deliverable we provide blueprints for use cases across five domains of mining, ports, logistics and transport, agriculture, energy and viniculture. Each domain has a cluster of use cases which provide an ecosystem to understand, design, prototype, validate and pilot end to end services.

Cluster 1: Industry

Use Case 1.1: IoT Mining Seismics

This UC focuses on micro-seismic sensing at a large-scale involving process such as data collection and processing for underground mining. Driven by efforts of financial incentives as shown by large seismic event that forced part of a mine to be closed, leaving billions of euros worth of invaluable ore inaccessible.

Use Case 1.2: Logistics of IoT

Explores the monitoring challenges of critical infrastructure and logistics which key success factors being measured such as live asset tracking, decision support software and accurate infrastructure data.

Use Case 1.3: Condition Monitoring and Predictive Maintenance in Mining

In situations and places where there may be limited or no stockpiles to buffer against sudden downtimes within the logistics chain, this use case focuses on ensuring uninterrupted material flow and logistics, which are essential for successful mining operations.

Use Case 1.4: IoT-Edge-Cloud Continuum for Digital Mines

Driving the future of digital services in underground mining, this use case acts as the integration platform for UC 1.1 and 1.3 where their data and analytics streams are aligned. Through the evolution into a complex ecosystem of distributed hardware, low-power IoT devices, edge computing nodes (for minimal latency) and mission – critical data centers.

Cluster 2: Smart Sustainable IoT Solutions in Valencia (Spain)

Use Case 2.1: Smart City Data Monitoring and Sustainable Mobility

This UC focuses on improving the sustainable mobility and environmental management in urban areas in key areas situated in Valencia and the Almussafes Industrial Park through real time monitoring. With effective collaboration between the local authorities and leveraging IoT such as sensors, radars, cameras, and other IoT devices.

Use Case 2.2: Smart and Sustainable IoT – Connected Campus

IoT devices will be used to monitor energy, waste management, water usage, environmental conditions or other parameters in real time. This data will then be integrated into a smart IoT platform for analysis with the goal to support the UPV campus in achieving net zero carbon neutrality while testing sustainability focused tools and mechanisms.

Use Case 2.3: Advanced Maritime and Terrestrial Traffic Management in Ports

Being tested on the Port of Valencia, a smart IoT platform will be deployed to support precise monitoring of real time risk and maritime during berthing to enhance truck movements. These advancements aim to improve safety, sustainability and operational efficiency.

Cluster 3A: AgriTech Transformation and Sustainability Initiative

Use Case 3A.1: Integrated Precision Agriculture and Crop Monitoring

This use case looks at delivering accurate crop health assessments, enabling precise and timely interventions and detecting pest infestations. This will be done through the utilization of IoT sensors such as plant wearables and UAVs and satellite imagery.

Use Case 3A.2: Advanced AgriRobotics for Autonomous Intervention

Through this UC, Agrirobots leverage data to atomize UGVs with AI-powered edge processing used for precision spraying and pest control. The aim of this use case us to minimize chemical use, improve farming efficiency and execute sustainable interventions.

Use Case 3A.3: Secure Data Management and Interoperability

A secure data framework is created in this use case, leveraging encryption and blockchain technology to protect data integrity and security across the agricultural value chain. This is achieved through a unified IoT network and a multi-cloud orchestration.

Use Case 3A.4: Smart Logistics and Supply Chain Optimization

This use case explores the dynamic adjustments that can be made to the operations by leveraging AI algorithms and real – time IoT data to ensure efficient delivery of agricultural products, minimizing waste and reducing environmental impact.

Cluster 3E: Edge Intelligence for Enhancing Grid Reliability In RES – Rich Distribution Grids

Use Case 3E.1: Harvesting Real-Time Flexibility from Active Electricity Grids

A cloud-edge platform for real-time flexible harvesting is being explored in this use case, wherein the platform will provide two primary services, optimal control for flexibility provision and real-time estimation of flexibility.

Use Case 3E.2: Ensuring Uninterruptible Power Supply for Fast EV Charges

Through the use case the reliability of chargers is promoted by leveraging predictive maintenance and resource optimization to nullify unexpected breakdowns by integrating to services – hours-ahead and day-ahead forecasting along with edge intelligence.

Use Case 3E.3: Predictive Maintenance and Monitoring of Biogas Plant Operations

This use case explores the implementation of a predictive maintenance and monitoring system featuring: Digital Twin Model, Predictive Maintenance and Real-time Process to enhance the reliability of electricity grids and the efficiency of operations of anaerobic digestion process in biogas plants.

Cluster 4: Smart Vineyards & Sustainable Winery Ecosystems

Use Case 4.1: Recycling, Maintenance and Logistics of IoT Sensors

This use case strongly emphasizes logistics, maintenance and the recycling of reusable IoT sensors within the healthcare supply chain. By leveraging a digital management system, this initiative promoted sustainability and enables efficient usage across multi-patient usage cycles.

Use Case 4.2: Sustainable Solution for Crops Water Use Efficiency

Through this use case sustainable water management and reduction in consumption is promoted by leveraging satellite optical remote sensing and data analytics to improve water use efficiency (WUE) in agriculture along with increased precision in irrigation methods that support ESG principles and the SDGs.

Use Case 4.3: Winery Production Using IoT-Enhanced OEE Analytics

A FIWARE-based IoT tool is used to improve winery efficiency by monitoring Overall Equipment Efficiency (OEE). This is developed into an AI/ML powers Manufacturing Execution System (MES) that helps optimize operations.

Use Case 4.4: AI-Driven Green Energy Vineyard Management

Uses AI to optimize renewable energy use across vineyard operations, dynamically managing connected devices and workloads based on real-time forecasts and 5G/6G connectivity to ensure uninterrupted, sustainable off-grid services.

We include there the requirements for the creation of an open platform capable of managing various industry sectors across different domains of the compute continuum while offering enhanced security, automation, and intelligence features. The use cases requirements drive the creation of the COP-PILOT platform as an overlay platform framework with any underlay technology spanning from IoT platforms to access segment technologies, to core infrastructure transport segments, and the compute environment.

This document forms a foundational component of the COP-PILOT project, which aims to develop a collaborative open platform for end-to-end orchestration across heterogeneous IoT–edge–core computing environments. The platform is designed to support cross-sector and multi-domain deployments, enabling intelligent, secure, and automated service delivery in strategic verticals such as mining, smart cities, agriculture, energy, and sustainable production ecosystems.

The COP-PILOT project aims to develop a Collaborative Open Platform for end-to-end orchestration across heterogeneous IoT-to-edge-to-core computing environments. COP-PILOT integrates advanced AI capabilities, including a Large Language Model (LLM)-based user interface, to simplify service onboarding and ensure smart SLA compliance through predictive analytics and zero-touch orchestration. The project places strong emphasis on open standardisation, interoperability, and secure data management, aligning with EU regulations and fostering innovation across European supply chains.

To achieve these objectives, this document details the initial COP-PILOT platform architecture. It is designed as a multi-layered framework capable of managing services both within and across multiple administrative domains. The architecture introduces a Distributed Domain Orchestration Layer (DDO-L) to manage resources, services, and data within a single private domain (e.g., a specific mine or smart city testbed). To connect these distinct domains securely, a Secure Integration Fabric (SIF-L) provides programmable, on-the-fly connectivity. Above this, an End-to-End Service Orchestration Layer (ESO-L) manages complex services that span multiple domains. This entire system is governed by the Business Management Layer (BM-L), which provides a unified user portal, service catalogues, and the previously mentioned LLM-based interface for simplified service management.

This deliverable provides the basis to capture requirements and define the use cases and systems so that the architecture can be refined and implemented. The deliverable includes the service and business models giving requirements for performance of a system which aims for interoperability across diverse infrastructure controllers, and robust data management in compliance with EU regulations.

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1 INTRODUCTION

This document forms a foundational component of the COP-PILOT project, which aims to develop a collaborative open platform for end-to-end orchestration across heterogeneous IoT–edge–core computing environments. The platform is designed to support cross-sector and multi-domain deployments, enabling intelligent, secure, and automated service delivery in strategic verticals such as mining, smart cities, agriculture, energy, and sustainable production ecosystems.

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This document outlines the ecosystem requirements for the COP-PILOT platform, including the initial architecture, stakeholder needs, and technical specifications. It is structured as follows:

- **Section 2 – Summary of Project**: Provides an overview of the COP-PILOT initiative, its objectives, and the thematic clusters of use cases. It includes a glossary of key terms referenced in the annex and a simplified view of the initial architecture to support stakeholder understanding.
- **Section 3 – A Summarised View of the Clusters and Their Respective Use Cases:** This chapter provides Infographics for each cluster and use case. The detaile bluepringts for each use case and cluster is given in the Annex.
- **Section 4 – COP-PILOT service and business models** across all piloting clusters, the initial layered platform architecture mapped to key technical work packages, and a granular module-level technical requirements analysis covering all architectural layers.
- **Conclusion**: Summarises the key findings and outlines next steps for platform development and stakeholder engagement.
- **Annex 1 - COP-PILOT Service Value Model Ecosystem Requirements**: Introduces the service and business models underpinning each cluster, including service templates and infrastructure requirements.
- **Annex 2 - Initial Platform Design**: Provides a detailed description of the COP-PILOT architecture, including its layered structure, orchestration components, and mapping to technical work packages.

- **Annex 3 – Technical Requirements Analysis**: Breaks down module-level requirements for each architectural layer, including business management, orchestration, infrastructure services, and secure integration.
- **Annex 4 – Technical Glossary References.**
- **Annex 5 – Cluster 1: Business Integration in Mining**: Details four mining-related use cases, focusing on seismic monitoring, logistics, predictive maintenance, and edge-cloud continuum integration. Each use case includes descriptions, actors, motivations, diagrams, and requirements.
- **Annex 6 – Cluster 2: Smart Buildings/Cities**: Explores urban and industrial use cases in Valencia and Almussafes, including traffic classification, flood mitigation, smart resource management, and maritime berthing assistance.
- **Annex 7 – Cluster 3A: Agritech Transformation and Sustainability Initiative (ATSI)**: Presents use cases in precision agriculture and agri-robotics, including real-time crop monitoring, autonomous interventions, and secure data management using blockchain.
- **Annex 8 – Cluster 3E: Energy Systems**: Focuses on energy flexibility, EV charging infrastructure, and predictive maintenance in biogas plants, demonstrating COP-PILOT's role in enabling resilient and sustainable energy operations.
- **Annex 9 – Cluster 4: Smart Vineyards & Sustainable Winery Ecosystems**: Covers use cases related to IoT sensor lifecycle management, water utilisation efficiency, and optimised winery production lines.
- **Annex 10 – Presents detailed information on the requirements for supporting Chapter 8.**

This deliverable sets the stage for subsequent technical and implementation work packages, ensuring that the COP-PILOT platform is grounded in real-world requirements and capable of supporting scalable, secure, and interoperable digital ecosystems across Europe.

2 PROJECT SUMMARY

2.1 PROJECT OVERVIEW

The COP-PILOT project aims to develop a Collaborative Open Platform for end-to-end orchestration across heterogeneous IoT-to-edge-to-core computing environments. It targets enabling cross-sector and multi-domain application deployments with enhanced security, automation, and intelligence, focusing on large-scale piloting clusters in strategic industries like mining, smart buildings, energy, and agriculture. The platform integrates advanced AI capabilities, such as a Large Language Model-based user interface for simplified service onboarding and smart SLA (Service Level Agreement) compliance through intelligent forecasting and zero-touch service invocation. COP-PILOT emphasizes open standardization, interoperability across diverse infrastructure controllers, and robust data management in compliance with EU regulations.

COP-PILOT piloting Clusters demonstrate real-world use cases including smart IoT management, sustainable agriculture, industrial IoT recycling, and smart manufacturing, fostering innovation and enabling a mature European supply chain for edge computing. Additionally, COP-PILOT facilitates market uptake through open calls supporting SMEs and startups, along with active standardization contributions and an open-source approach for broad adoption. The project's comprehensive impact spans technological advancements, economic growth, public trust in edge computing, and strategic European leadership in the global data economy.

2.2 LIST OF USE CASES

This section presents a list of use cases that form the backbone of the COP-PILOT project's applied research and development efforts (see Table 2-1). These use cases are grouped into thematic clusters, each addressing specific industrial or societal challenges through edge-cloud orchestration and intelligent service deployment. The clusters span domains such as mining, smart cities, agriculture, energy systems, and sustainable production ecosystems. For each use case, a brief description is provided alongside its associated cluster, with placeholders for the respective owner organizations. This section serves as a reference point for understanding the practical applications and stakeholder involvement across the project.

Table 2-1 List of 20 distinct use cases and their names.

Number	Description	Owners
Cluster 1: Business Integration in Mining		
1.1	IoT mining seismics	ROC
1.2	Logistics IoT	TAB
1.3	Condition Monitoring and Predictive Maintenance in Mining	PAB, HOSCH
1.4	IoT-Edge-Cloud Continuum for Digital Mines	LTU, RISE
Cluster 2: Smart Building/Cities		
2.1a	UC 5G-Connected Radars for Traffic Classification and Vehicle Counting	VCH
2.1b	Flood warning and mitigation systems through radar sensing	ALM
2.2	Smart Resources Management in the UPV campus	UPV
2.3	Maritime traffic monitoring and berthing assistance	VPF
2.4a	IoT-Driven Smart Building Management	VCH

2.4b	IoT-Based Environmental Quality Monitoring System	ALM
Cluster 3A - AgriTech Transformation and Sustainability Initiative (ATSI)		
3A.1	Integrated Precision Agriculture and Crop Monitoring	AGA
3A.2	Advanced AgriRobotics for Autonomous Intervention	AUA
3A.3	Secure Data Management and Interoperability	iLink
Cluster 3E - Smart & Resilient res-rich, cross-sector coupled distribution grids		
3E.1	Harvesting in real-time flexibility from active electricity distribution grids	UoP
3E.2	Ensuring Uninterruptible Power Supply for Fast EV Chargers	DEI
3E.3	Predictive Maintenance and Monitoring of Anaerobic Digestion in a Biogas Plant	BPO
Cluster 4 – Smart Vineyards & Sustainable Winery Ecosystems		
4.1	Recycling, Maintenance, and Logistics of IoT sensors	RedZinc

4.2	Water Utilisation Efficiency	Terraview
4.3	Sustainable optimized Winery Production Lines	JIG
4.4	AI-Driven Green Energy Vineyard Management	Nokia

2.3 GLOSSARY - DEFINITIONS

See **Annex 4**.

2.4 A SIMPLIFIED VIEW OF THE INITIAL COP-PILOT ARCHITECTURE

To better convey COP-PILOT to the EU citizens and ecosystem of potential users, we deem important to provide a simplified view of the COP-PILOT architecture that abstracts away low-level details without losing essential context. Figure 2-1 visualizes a simplified view of the initial COP-PILOT architecture, which is briefly explained in the rest of this section. This figure boils down the complex COP-PILOT architecture into 3 essential pieces (i) the COP-PILOT domains where the platform offers domain-level orchestration and Data Management services to every individual domain stakeholder in the COP-PILOT ecosystem for managing compute, network, and data resources, (ii) a secure integration fabric for allowing secure on-the-fly data and service-level interactions between multiple domains, and (iii) an end-to-end service orchestration platform for managing services that span across multiple domains, thus highlighting the “collaborativeness” of the COP-PILOT system.

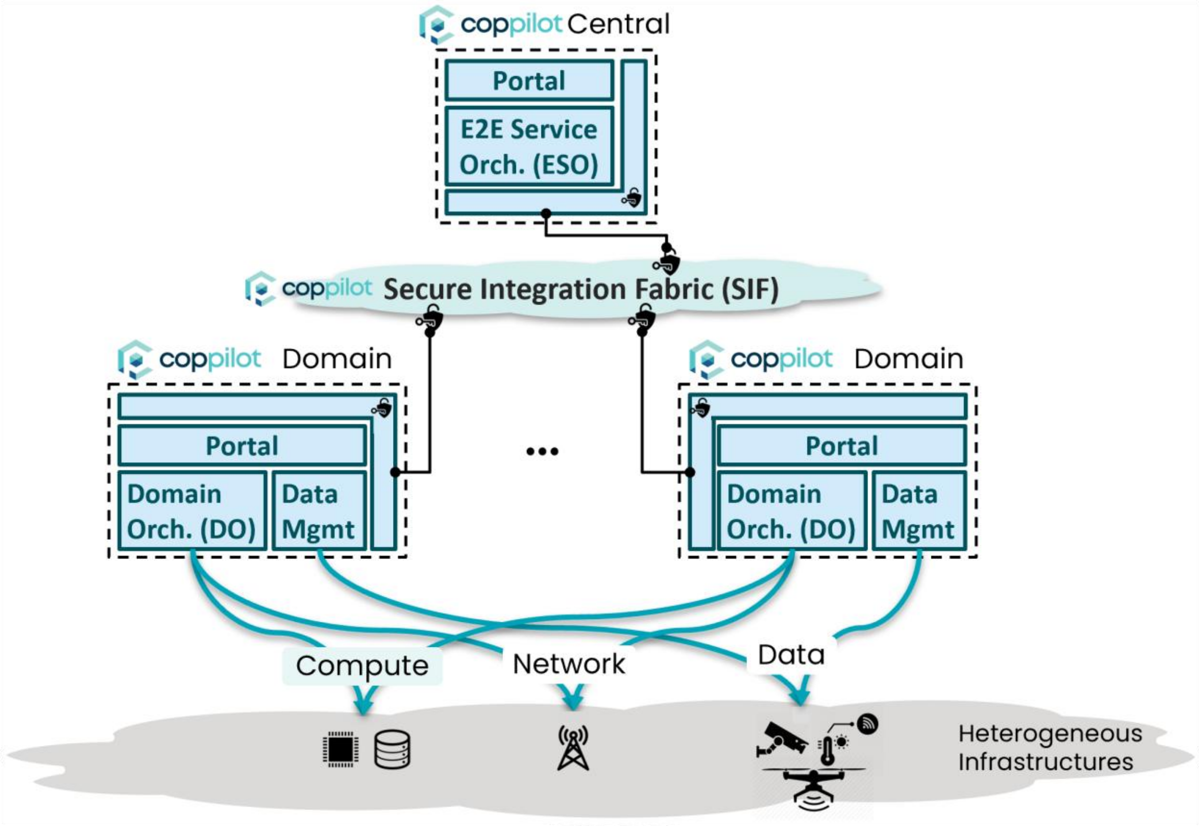

Figure 2-1 A minimal view of the initial COP-PILOT architecture.

Note that the minimal view of the initial COP-PILOT architecture shown in Figure 2-1 focuses solely on COP-PILOT elements. To make this view more complete, Figure 2-2 adds additional items to sketch the entire ecosystem around COP-PILOT: (i) the layers of the initial architecture shown at the left hand side in Figure 2-2, (ii) the span of the infrastructure at the bottom part in Figure 2-2, (iii) the various stakeholders associated with COP-PILOT (see user icons in Figure 2-2), (iv) the primary vertical sectors that COP-PILOT facilitates via the piloting activities in WP4 (top part in Figure 2-2), and (v) the way COP-PILOT and third-party services interact with the platform. Note also that the pink-highlighted boxes in Figure 2-2 are presented as distinct aspects of the platform in the following paragraphs.

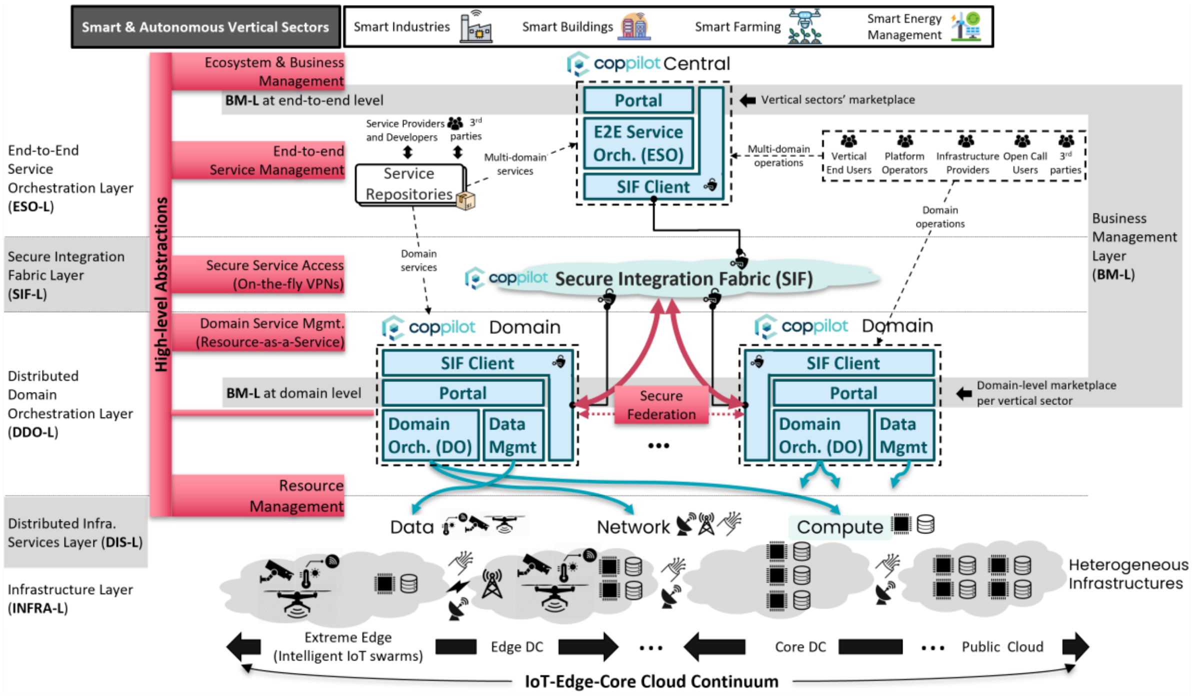

Figure 2-2 A simplified equivalent of the initial COP-PILOT architecture.

Resource management: Hide details of complex, large scale, and multi-tenant testbeds

At the bottom part in Figure 2-2, the infrastructure layer (INFRA-L) is depicted as a large pool of compute, network, and data resources spread across the entire IoT-edge-to-core continuum. Specifically, (i) extreme edge and edge domains offer various types of sensors with or without compute capabilities, while the latter domains may also host private networking infrastructure (e.g., private 5G) for channelling the data of these sensors towards a (core/edge) datacentre, (ii) core domains offer larger amounts of compute capacity for hosting either applications or core network functions (e.g., those corresponding to a private 5G core network), and (iii) hyperscalers are always available for further increasing the required compute capacity through VMs/clusters when needed. This layer includes not only the large COP-PILOT clusters' infrastructure, but also potential infrastructure that may appear during the two Open Call rounds or third parties that wish to integrate their infrastructure with the COP-PILOT platform in the future. On top of this layer, infrastructure providers typically expose a set of Distributed Infrastructure Services for managing the underlying hardware without directly exposing it to overlay systems. This layer - titled DIS-L – is the interface of the COP-PILOT platform with any testbed, as it is responsible for direct resource management over the physical resources. The objective of COP-PILOT is to demonstrate ability to integrate with any kind of infrastructure service, thus embrace heterogeneous testbeds that pertain to different vertical sectors (not necessarily the 4 vertical sectors addressed by the COP-PILOT clusters).

Domain-level service & data management: Foster any Resource-as-a-Service

Today's infrastructures tend to be multi-domain, while different administrative entities appear as operators/owners in each domain. On top of every such domain, COP-PILOT employs a domain-level management platform that is comprised of: (i) a Domain Orchestrator instance, (ii) a Data Management instance, and the overlay Business Portal at the domain level. Both DO and DM establish bindings with the underlying domain infrastructure services (DIS-L) for exposing compute, network, and data-as-a-service using standardized service, resource, and data management APIs (see Figure 2-2). This is a key abstraction of COP-PILOT that allows infrastructure owners to easily expose the abilities of their hardware without disclosing resource-level details to the consumers. Having resources-as-a-service also allows the infrastructure owners to monetize these services in the COP-PILOT marketplace, linking them with products that can be purchased by interested stakeholders.

Secure service access management: Security and trust built-in COP-PILOT

Within every domain, COP-PILOT's Secure Integration Fabric (SIF) undertakes to create encrypted tunnels for exposing certain domain-level services towards the outside world (i.e., another domain or the upper layer). The COP-PILOT SIF undertakes to offer zero-trust on-the-fly VPNs towards any service within the entire COP-PILOT ecosystem, introducing a key abstraction that ensures security and trust. This abstraction takes away the huge complexity of managing traditional VPNs in large ecosystems of multiple administrative entities. To establish traditional VPNs within COP-PILOT, multiple IT departments in every cluster should issue VPN accounts, credentials, and configuration files for several external parties, not to mention that this needs to happen across additional IT departments by the partners who will appear during two open call rounds.

COP-PILOT revisits the way private networking should be done nowadays by leveraging recent advancements in secure software-defined overlay networking using OpenZiti (provided by the COP-PILOT consortium member *TATA*). This allows COP-PILOT to set up a root-of-trust domain where the control plane of the secure integration fabric will be publicly exposed as a cloud-managed service to the entire ecosystem. COP-PILOT parties who wish to enter the COP-PILOT ecosystem will exploit the COP-PILOT business management portal to register a new domain under the COP-PILOT realm and consequently declare domain resources and services that the domain owner wishes to expose through the integration fabric.

Secure federation

Apart from exposing domains and domain services in a secure and trusted manner, the COP-PILOT SIF will be used as a secure and trusted data federation fabric to east-west interconnect multiple COP-PILOT Data Management platform instances. This will allow secure sharing of data between domains to enable collaborative scenarios throughout the COP-PILOT piloting activities.

End-to-end service management: Manage services across a complex private continuum

A higher-tier orchestration layer is added above the SIF to provide the notion of end-to-end management of services and resources in the multi-domain and multi-stakeholder/tenant era of 6G. This layer (titled ESO-L) introduces COP-PILOT's End-to-end Service Orchestrator (ESO), which binds with multiple DO instances across multiple domains to federate domain-level marketplaces into a large multi-domain marketplace of services offered to the COP-PILOT stakeholders. This is done via another dedicated business portal on top of the ESO (complementary to the business portal atop the DO), which introduces a business management layer at the level of multiple domains and end-to-end services. This is the reason that the Business Management Layer (BM-L) of COP-PILOT appears vertically in Figure 2-2; conceptually speaking, this layer is the top-most layer of the COP-PILOT architecture as it appears in the detailed version of the architecture in Annex 2. However, when the architecture gets instantiated into a real multi-domain platform, the business layer appears both within every domain (to enable domain level business operations), but also in an end-to-end fashion (atop ESO-L).

Ecosystem and Business Management

Finally, a modern user portal design complements the rest of the platform with views that allow all kinds of stakeholders (i.e., domain-level stakeholders in every domain, infrastructure owners, platform administrators, service providers, vertical end users, 3rd parties, etc.) to exploit the rich set of APIs offered by the DO and DM in every domain as well as the ESO in the central management domain in order to perform platform, service, resource, and data management operations in a straightforward and user friendly manner. Key workflows for COP-PILOT stakeholders get triggered from the portal, thus abstracting the low-level details that appear in the ESO, DO, and DM APIs. Further details about the initial COP-PILOT architecture are provided in Annex 2.

2.5 LAYERS AND ABSTRACTIONS

The layers of the COP-PILOT architecture outlined above are further detailed in Section 9.1. However, this section provides a high-level view of the key abstractions offered by COP-PILOT in each layer. These abstractions are summarized in Table 2-2, categorized as (i) abstractions that COP-PILOT leverages from existing systems/services and (ii) new abstractions that COP-PILOT introduces as novelties.

Table 2-2: Summary of abstractions per layer of the COP-PILOT architecture.

COP-PILOT Architecture Layer	Abstraction leveraged/offered by COP-PILOT
INFRA-L	**Existing abstractions leveraged by COP-PILOT:** This layer contains pure hardware elements of various types (e.g., compute, network, sensors, etc.). COP-PILOT leverages existing abstractions offered by infrastructure elements, such as: • compute virtualization abstractions that render either physical or virtual machines acting both as compute nodes. • network virtualization abstractions that homogenize the way physical or virtual network elements (e.g., routers) behave. • data virtualization abstractions that homogenize the way physical data sources and virtual data sources (e.g., an emulated sensor) behave. **New abstractions introduced by COP-PILOT:** Not available; COP-PILOT is not a project that attempts to offer hardware-level novelties.
DIS-L	**Existing abstractions leveraged by COP-PILOT:** State-of-the-art resource management platforms establish bindings with the massively heterogeneous underlying data plane and expose APIs for implicitly interacting with the devices. This totally hides the complexity of the underlying hardware, while offering effective programmatic interfaces to manage the resources. Characteristic examples of such platforms are Virtual Infrastructure Management platforms that slice compute devices (edge processors, CotS or specialized servers) into VMs. **New abstractions introduced by COP-PILOT:** Not available; COP-PILOT is not a project that attempts to offer new resource management technologies but rather provides a modular platform to interface all existing (and upcoming) ones.
DDO-L	**Existing abstractions leveraged by COP-PILOT in the area of Domain-level network and service management:** State-of-the-art and open Operations Support Systems (OSS), such as ETSI OpenSlice, offer powerful abstractions for managing the compute and network resources of any domain using standardized APIs that

	organize resources and services in a domain's marketplace (i.e., catalogues), while offering resource and service ordering/runtime management/termination. **Existing abstractions leveraged by COP-PILOT in the area of Data Management:** State-of-the-art and open Data Management systems, such as FIWARE's Context Broker or Eclipse Arrowhead, offer similar abstractions for managing data as-a-service using standardized APIs, while allowing for east-west sharing of data across multiple instances of the Data management platform. **New abstractions introduced by COP-PILOT:** 1. **Marketplace with fully automated compute-as-a-service:** A dedicated catalog/category for compute service providers is offered by COP-PILOT, allowing for dynamic provisioning of compute clusters of any scale and locality on-demand and in a zero-touch manner. This extends existing solutions (i.e., ETSI OSL) with additional amount of automation. 2. **Marketplace with fully automated private 5G-as-a-service:** A dedicated catalog/category for network service providers is offered by COP-PILOT, allowing for private end-to-end 5G system deployments with certain slicing characteristics on demand and in a zero-touch manner. This extends existing solutions (i.e., ETSI OSL) with additional amount of automation. 3. **Marketplace with fully automated data management instantiation services:** The COP-PILOT system can dynamically ingest streams from distributed data spaces by instantiating the COP-PILOT Data Management platform on demand, wherever is needed. This allows COP-PILOT to create a Pan-European data space infrastructure with minimal human intervention. This establishes complete integration between open platforms, i.e., ETSI OSL and FIWARE's Context Broker as well as ETSI OSL and Eclipse Arrowhead, introducing automation on the distributed deployment of the Data Management platform. 4. **Treating legacy applications as containerized black boxes:** COP-PILOT embraces existing innovation in the 4 vertical sectors (i.e., smart energy management, smart industries, smart agriculture, and smart cities), accepting any type of modern application if it is only containerized. Application developers

	may choose the programming language and service packaging technology of their choice, as no other restriction is imposed by the platform. In other words, COP-PILOT treats overlay applications as blackboxes, to embrace any type of vertical services within the COP-PILOT ecosystem. 5. **Offering an ultra-low complexity application development framework:** COP-PILOT's distributed Data Management stratum allows application developers to focus on the real novelties of their services, thus omit the implementation of data ingestion, processing, persistence, and federation. All these operations are done by the platform; thus, application developers only require APIs to consume these services from COP-PILOT. This renders service development and testing processes much shorter (less code is needed), and less error-prone (data management operations are well-tested by COP-PILOT), thus substantially speeding up time-to-market for new disruptive services.
SIF-L	**Existing abstractions leveraged by COP-PILOT:** COP-PILOT leverages ACROSS: the first ever orchestration platform that introduced the idea of a Secure Integration Fabric (using the OpenZiti open-source platform) as a secure overlay network to interconnect private infrastructures and services. COP-PILOT uses ACROSS as a baseline system, builds upon its key pillars (i.e., the SIF, DO, and ESO), and introduces new parts (e.g., Data Management platform was missing from ACROSS) to substantially increase its TRL for large scale pilots. **New abstractions introduced by COP-PILOT:** For the first time, COP-PILOT will exploit the SIF to east-west federate data across domains in a secure and trusted manner. This feature will greatly simplify the development of collaborative applications that will "inherit" means to communicate with remote services and data sources from the COP-PILOT platform. To ensure this feature, COP-PILOT SIF (i.e., OpenZiti) will be integrated with the COP-PILOT Data Management (FIWARE Context Broker / Eclipse Arrowhead) platform for the first time.
ESO-L	**Existing abstractions leveraged by COP-PILOT:** Commercial solutions are available for managing multi-domain services that typically span across multiple compute clusters. Example solutions are

	RedHat's ACM, Google Anthos, Azure Arc, etc. These solutions offer useful means for managing geo-distributed compute clusters that span different administrative domains. **New abstractions introduced by COP-PILOT:** Most of the above solutions are sourced source, while they fall short to manage resources beyond clusters (e.g., 5G, transport network, data resources). COP-PILOT identified this gap and promotes the expansion of an existing open-source OSS platform (ETSI OpenSlice) with an additional module that deals with end-to-end service management atop multiple domains. This new ETSI Module Development Group – titled ETSI Hyper Orchestrator (HypO) – is driven by key COP-PILOT partners, and the project contributes not only to its constitution, but also to the development and integration activities of this platform to strengthen ETSI OSL. A summary of abstractions offered by the COP-PILOT ESO follows: • Marketplace for vertical sector applications using standardized TMF service management APIs. This marketplace is easily expandable to accommodate the upcoming open calls or future adopters of COP-PILOT. • Ability to combine vertical sector applications with domain-level compute, network, and data services to create complex end-to-end service graphs. • Native integration with public or private service registries for pulling application artefacts developed by any service provider (either within COP-PILOT or third party). • Native integration with the SIF to manage the underlying domains as well as expand the platform to new domains. • Native integration with industry-grade telemetry solutions to offer end-to-end service telemetry, logs, and dashboards as-a-service.
BM-L	**Existing abstractions leveraged by COP-PILOT:** COP-PILOT leverages the portals of existing systems, such as the ETSI OpenSlice portal (to be used as an initial version of the COP-PILOT DO business portal) and the OpenZiti portal (to be used as an initial version of the COP-PILOT SIF portal).

	New abstractions introduced by COP-PILOT: COP-PILOT introduces a new business portal for end-to-end multi-domain services that becomes a single point of reference for COP-PILOT stakeholders who wish to see the entire layout of the system across Europe, as it offers user interfaces that visualize all active networks under the platform, active domains connected with these networks, their domain orchestration services, and active domain-level compute facilities via an interactive map. Apart from visualizing and managing the platform itself (via an interactive map), the business portal also offers dedicated views to simplify the following operations: • Views for managing the COP-PILOT domain-level and multi-domain marketplaces. This allows us to design and onboard new service specifications as well as manage service categories and service catalogues. • Views for ordering services and resources from the marketplace using a shopping cart where multiple service/resource specifications can be included and ordered. • Views for inspecting the services/resources runtime information and for acting upon these services, via specific actions and/or policies. • Views for visualizing service and infrastructure telemetry metrics and logs using dashboards. • View for managing (Create, Read, Update, Delete) service secrets in a secure manner, using industry-grade solutions for storing these secrets as encrypted data. • View for platform expansion to new private domains. This view allows the user to interact with COP-PILOT SIF and guides the user on what steps need to be followed for achieving the onboarding of a new domain onto the platform.

As we want to keep WP2 documents at an abstract architectural level, we will use the upcoming WP3 deliverables to provide additional details on the above abstractions, combining this information with further technical details about the actual platforms that will be used (and extended by COP-PILOT) to ensure these abstractions. This effort will also relate to the standardization and dissemination activities in WP7, as all these contributions to create the above abstractions will be demonstrated in events and venues related to open-source development groups and standards.

3 BLUEPRINTS EXECUTIVE SUMMARY FOR COP-PILOT

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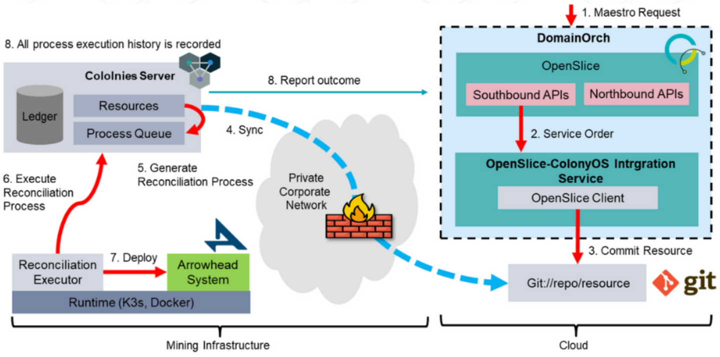
Cluster 1: Business Integration In Mining

Use Case Overview Diagram



Ambition, Mission and Objectives

- Enable secure, service-oriented integration for mining with trusted data access and flexible IoT–Edge–Cloud workload placement under strict safety and governance constraints.
- Demonstrate multi-vendor, multi-technology integration across key mining functions and validate automated, scalable deployment in realistic operating conditions.
- Replace manual, site-specific solutions with interoperable, scalable patterns that accelerate digitalisation and reduce operational and IT complexity.

Description

Business Integration in Mining addresses the integration of computing platforms, data services, and deployment models in highly constrained mining environments. It demonstrates secure, interoperable solutions that operate across on-prem edge systems and controlled cloud resources. Through use cases in seismic monitoring, underground logistics and asset tracking, and conveyor condition monitoring, the cluster shows how scalable orchestration and open interfaces can reduce silos and accelerate digitalisation in mining operations.

Pathway to Execution

Execution requires close alignment between business value drivers and technical delivery. Use cases must clearly target safety, productivity, cost efficiency, and compliance, while shared architectures, open interfaces, and common orchestration frameworks ensure consistent deployment across diverse mine environments. Continuous feedback between operators, technology providers, and platform developers is essential to balance operational constraints with innovation and ensure technical scalability and security deliver measurable business impact.

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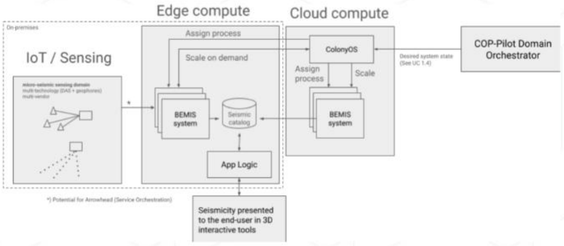
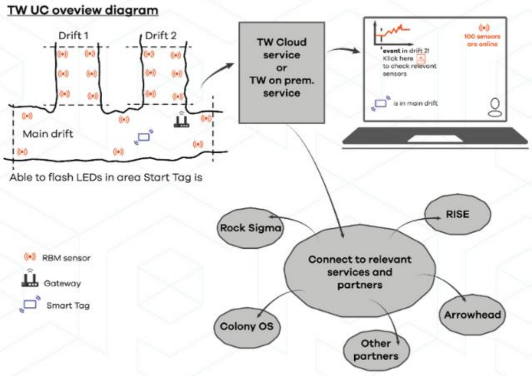
Cluster 1 Use Case Summary

UC 1.1



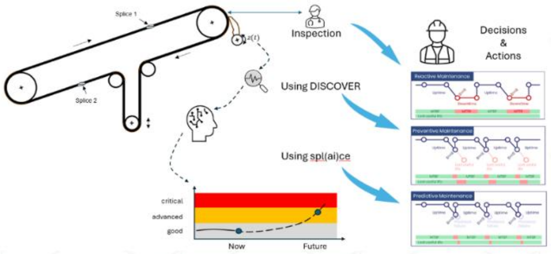
UC 1.1 enhances underground mining safety by using microseismic sensing and data processing to better understand rock mass behaviour through a unified, interoperable edge-to-cloud workflow.

UC 1.2



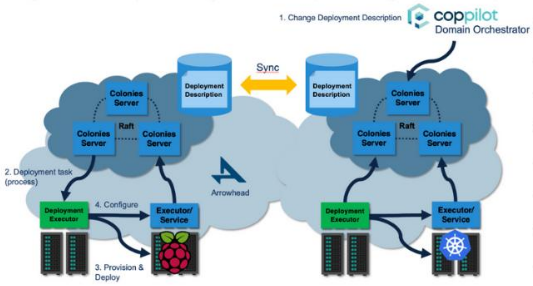
Through this use case, IoT-enabled smart rock bolts accurately track personnel, vehicles, and equipment underground, improving operational efficiency and reducing time lost locating assets.

UC 1.3



UC1.3 uses data from IoT-enabled belt scrapers, Edge/IoT devices and SCADA, to monitor components in belt conveyors to detect/predict damages reducing failures and downtime. A scalable edge-cloud computing and analytics continuum is demonstrated.

UC 1.4



Use Case 1.4 demonstrates a unified IoT–Edge–Cloud architecture for digital mining, enabling low-latency, scalable, and resilient operations by integrating earlier Cluster 1 use cases.

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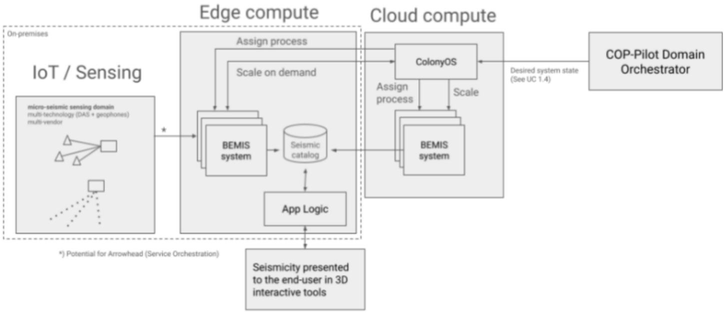
Use Case 1.1

IoT Mining Seismics



*) Potential for Arrowhead (Service Orchestration)

Description

This use case focuses on microseismic sensing and data processing to improve safety and understanding of rock mass behaviour in underground mining. Mining activities induce seismic events as stress conditions change, which must be monitored to manage the risk of damaging seismicity. The solution enables a unified, multi-vendor and multi-technology workflow covering sensing, data acquisition, processing, and visualisation. RockSigma's BEMIS platform, enhanced with COP-PILOT features, supports interoperable sensor networks, flexible deployment models, and edge-to-cloud processing while meeting mine operator data and infrastructure requirement

Functional Requirements

This system supports reliable microseismic monitoring through trigger-based seismic sensing and intuitive data visualisation of both historical and near-real-time events. It should enable automated compute provisioning via COP-PILOT integration where feasible, while prioritising low-latency event processing (≈50 ms under nominal conditions). Communication links are designed to ensure robust data transfer with a target uptime of approximately 99.9%, accounting for challenging underground environments.

Market Business Requirements

The market business requirements aim to improve productivity and technical flexibility. Enhanced seismic data processing supports a deeper understanding of rock mass behaviour, reducing incident-related production disruptions for mine operators. For application developers, the solution should enable flexible placement of computational workloads across the compute continuum and support scalable processing power. A distributed, microservice-based architecture allows systems to adapt to customer-specific needs and efficiently handle increasing data volumes as operational demands

Instantiation of Use Case

Dense microseismic sensors are deployed underground to continuously capture rock activity. Data is processed across an IoT–edge–cloud continuum, combining on-site sensing, edge analytics, and cloud platforms (i.e.., BEMIS). COP-PILOT orchestrates data flows and compute resources, enabling interoperable, multi-vendor integration and scalable deployment across mining environments.

The real benefit in the use case

The solution enables early detection of seismic risks and improved understanding of rock mass behaviour. This enhances worker safety, reduces unexpected shutdowns, and prevents loss of valuable ore. Automated data processing and orchestration support faster decision-making, lower operational costs, and more reliable mining operations.

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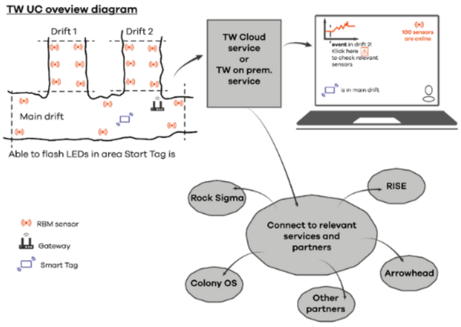
Use Case 1.2

Logistics of IoT



Description

Use Case 1.2 focuses on high-accuracy asset tracking in underground mining using IoT-enabled smart rock bolts. Assets include personnel, vehicles, and equipment, reducing time lost locating resources and improving operational efficiency. The solution builds on ThingWave's Digitalised Ground Support (DGS) system, extending it with enhanced sensors, positioning, and tracking capabilities. Smart rock bolts form a wireless IoT network that supports asset localisation

Functional Requirements

The functional requirements for this use case include high-performance, secure monitoring and asset tracking within the TAB DGS solution. The system must support high data-stream bandwidth (up to 10,000 packets per second), low-latency alarm detection (≤10 seconds), and scalability to at least 1,000 sensors per gateway. It must ensure accurate rock bolt rupture detection (±10% of bolt length), rapid fault identification, and regular positional updates for asset tracking. Integration with the ColonyOS/Arrowhead platform is required, alongside robust data security for platform authentication and data transmission.

Market Business Requirements

The market business requirements focus on cost efficiency, scalability, and operational productivity. The solution must significantly reduce deployment costs by cutting physical installation time by over 50% and configuration time by more than 60%. Improved asset monitoring is expected to lower asset-related costs by reducing losses and replacement needs. Additionally, automated rock bolt status reporting replaces frequent manual tunnel inspections, delivering over 100 status reports per day and substantially reducing ongoing operational costs.

Instantiation of Use Case

IoT-enabled smart rock bolts and sensors are deployed across underground infrastructure to track personnel, vehicles, and equipment. Data is transmitted via wireless networks and integrated into the ThingWave's DGS, with COP-PILOT enabling real-time data aggregation and analytics across interoperable systems.

The real benefit in the use case

The solution improves operational efficiency by enabling accurate, real-time asset tracking and reducing time spent locating resources. It enhances safety by maintaining visibility of personnel and equipment, while lowering costs through reduced manual inspections and optimised logistics workflows.

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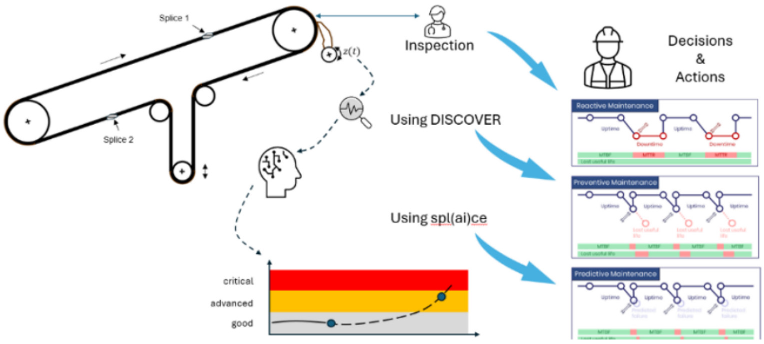
Use Case 1.3

Condition Monitoring and Predictive Maintenance In Mining



Description

Continuous material flow is critical in mining, making belt conveyor reliability and their uptime essential. This use case exploits data from IoT-enabled belt scrapers, SCADA systems, and other IoT/edge devices to monitor conveyor condition during operation. Combining Hosch-Iris sensing technologies and Predge Conveyor Analytics and AI, conveyor components degradation, such as belt or rollers, can be is continuously assessed and damages/failures are detected/predicted, enabling timely alerts, predictive maintenance. A scalable edge/cloud compute and analytics continuum to reduce risks and downtimes is demonstrated.

Functional Requirements

The functional requirements for this use case cover the full data lifecycle, from sensing to decision-making. The system must capture condition data, like e.g. scraper movement data tracking the belt surface, securely transmit measurements to the Hosch Iris and Predge cloud, and ingest data into the storage systems. Bidirectional data provisioning services support multiple users, while analytics processes generate actionable insights on component condition. These insights are provisioned using decision support system for maintenance.

Market Business Requirements

The business requirements focus on maintenance predictability and cost-efficient deployment. The solution must detect conveyor belt damage at least eight hours before it becomes critical in over 90% of cases, reducing the risk of unplanned downtime. In addition, automated deployment and orchestration should significantly improve scalability while cutting installation and commissioning time by more than 50%.

Instantiation of Use Case

IoT sensors and SCADA systems monitor conveyor belts and critical equipment in real time. Data is processed at the edge and in the cloud using analytics platforms (i.e., Hosch-Iris and the Predge platform), with COP-PILOT orchestrating data ingestion, processing, and service delivery across distributed environments.

The real benefit in the use case

The system enables early detection of faults and predictive maintenance, reducing unplanned downtime and maintenance costs. It ensures continuous material flow, improves equipment reliability, and extends asset lifespan, supporting more efficient and resilient mining operations.

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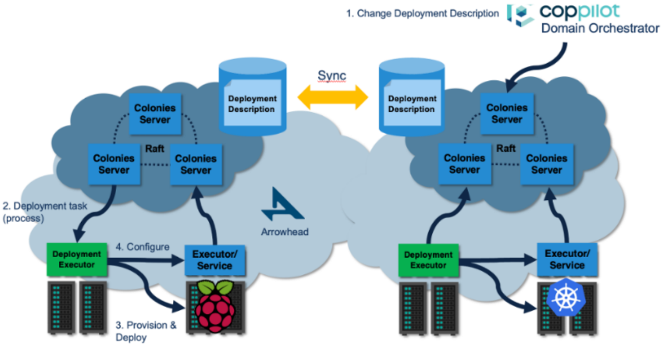
Use Case 1.4

IoT-Edge-Cloud-Continuum For Digital Mines



Description

Use Case 1.4 demonstrates a unified IoT–Edge–Cloud continuum for digital mining operations, enabling low-latency processing, scalability, and resilience across distributed computing resources. A testbed at RISE's ICE Datacentre simulates underground mining conditions to validate dynamic resource provisioning and data pipelines. ColonyOS provides federated orchestration and autoscaling, while Eclipse Arrowhead ensures secure edge-level interoperability. UC1.4 integrates earlier Cluster 1 use cases to demonstrate the COP-PILOT edge-to-cloud architecture.

Functional Requirements

The functional requirements for this use case define how services, compute, and deployments are orchestrated across the Edge-to-Cloud continuum. Service orchestration ensures secure connectivity, identity management, and federated data exchange between sensors, controllers, and platforms. Compute orchestration enables resilient, policy-driven execution of distributed workloads, while deployment orchestration automates provisioning, scaling, recovery, and lifecycle management to optimise performance, reliability, cost, and sustainability across edge and cloud environments.

Market Business Requirements

This business requirement focuses on reducing IT-related costs through advanced automation and orchestration. By efficiently deploying, configuring, and scaling computational resources, the solution minimises manual intervention and operational overhead. This reduces the time, effort, and cost associated with managing IT infrastructure and platforms, delivering measurable efficiency and cost savings for the organisation.

Instantiation of Use Case

This use case integrates sensing and analytics from UC 1.1, 1.2, and 1.3 into a unified IoT–edge–cloud architecture. Distributed IoT devices, edge nodes, and cloud systems are orchestrated via COP-PILOT, using technologies like ColonyOS and Eclipse Arrowhead to enable seamless deployment, scaling, and data exchange.

The real benefit in the use case

The integrated continuum enables low-latency, scalable, and resilient operations by optimising resource usage across edge and cloud. It reduces IT overhead through automation, improves interoperability, and accelerates digital transformation with real-time insights and more efficient mining processes.

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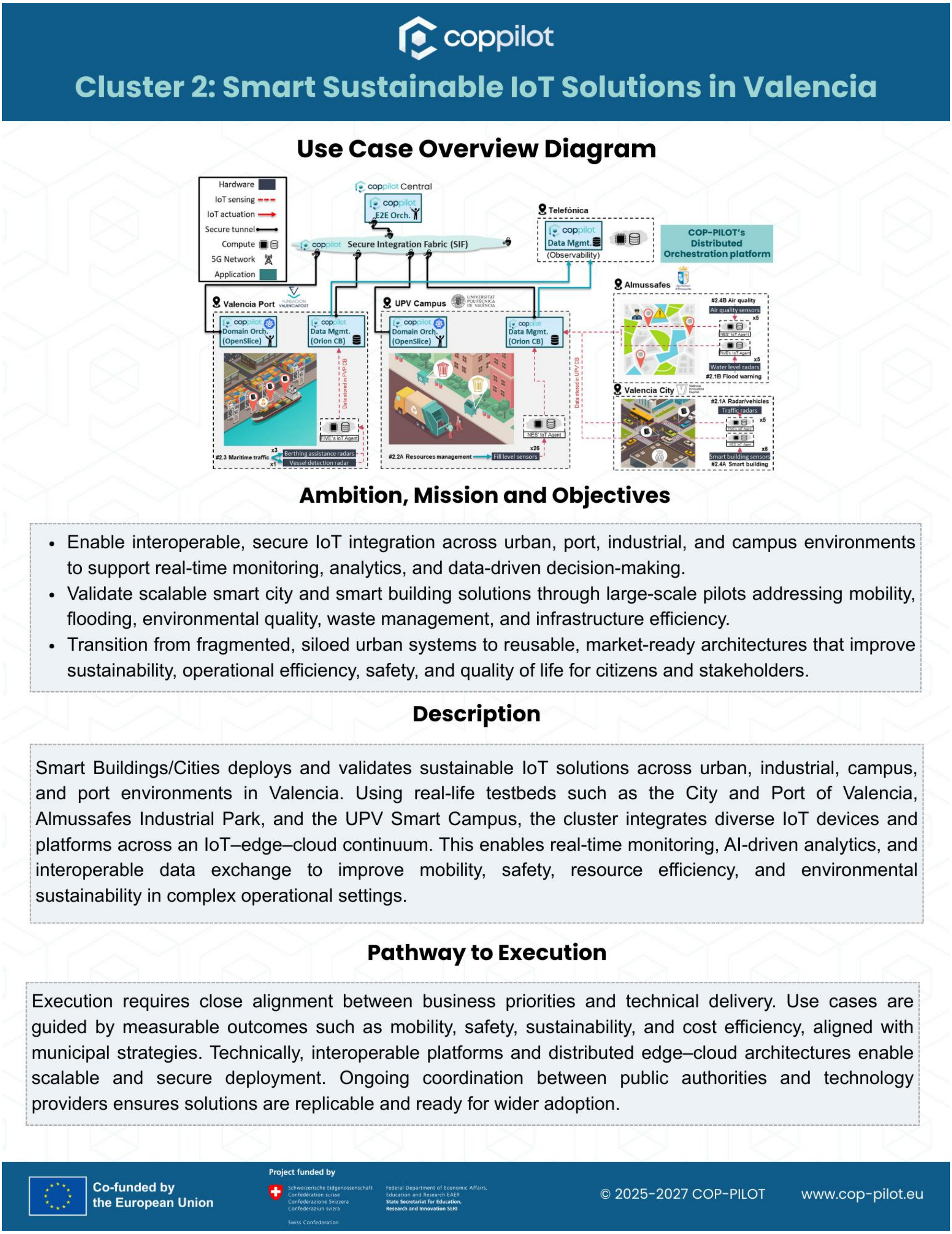

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Cluster 2: Smart Sustainable IoT Solutions in Valencia

Use Case Overview Diagram

Ambition, Mission and Objectives

- Enable interoperable, secure IoT integration across urban, port, industrial, and campus environments to support real-time monitoring, analytics, and data-driven decision-making.
- Validate scalable smart city and smart building solutions through large-scale pilots addressing mobility, flooding, environmental quality, waste management, and infrastructure efficiency.
- Transition from fragmented, siloed urban systems to reusable, market-ready architectures that improve sustainability, operational efficiency, safety, and quality of life for citizens and stakeholders.

Description

Smart Buildings/Cities deploys and validates sustainable IoT solutions across urban, industrial, campus, and port environments in Valencia. Using real-life testbeds such as the City and Port of Valencia, Almussafes Industrial Park, and the UPV Smart Campus, the cluster integrates diverse IoT devices and platforms across an IoT–edge–cloud continuum. This enables real-time monitoring, AI-driven analytics, and interoperable data exchange to improve mobility, safety, resource efficiency, and environmental sustainability in complex operational settings.

Pathway to Execution

Execution requires close alignment between business priorities and technical delivery. Use cases are guided by measurable outcomes such as mobility, safety, sustainability, and cost efficiency, aligned with municipal strategies. Technically, interoperable platforms and distributed edge–cloud architectures enable scalable and secure deployment. Ongoing coordination between public authorities and technology providers ensures solutions are replicable and ready for wider adoption.

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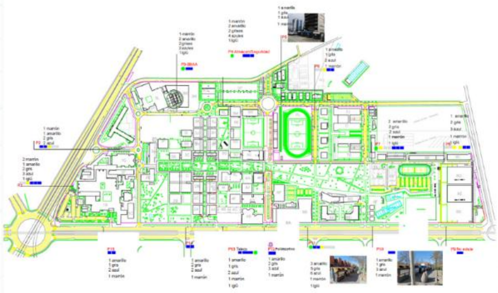
Cluster 2 Use Case Summary

UC 2.1A

UC 2.1A uses radar-based vehicle classification with real-time AI analytics to improve traffic management, road safety, and urban mobility efficiency.

UC 2.2



The use case establishes a smart, data-driven waste management system at UPV using fill-level sensors and IoT platforms to enable real-time monitoring, improve environmental assessment, and support informed.

UC 2.3

Use case 2.3 uses radar-based tracking to deliver precise, real-time vessel positioning and orientation, improving port safety and efficiency.

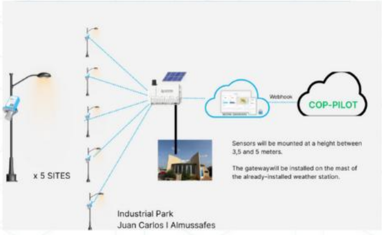
UC 2.1B

This use case monitors water-level through NB-IoT connected radars for flood monitoring

UC 2.4A

This use case turns La Harinera into a smart building using IoT sensors for real-time monitoring of occupancy, comfort, and energy use.

UC 2.4B



Sensors will be mounted at a height between 3,5 and 5 meters.

The gatewaywill be installed on the mast of the already-installed weather station.

Through this use case a LoRaWAN network is used to monitor formaldehyde levels in real time, enabling alerts, emergency response, and improved industrial safety.

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Use Case 2.1A

5G - Connected Radars For Traffic Classification and Vehicle Counting

Description

This use case addresses current limitations in traffic monitoring by introducing radar-based vehicle classification to identify cars, two-wheelers, and trucks entering Valencia. Integrated into the VLCi platform and connected via 5G, the solution enables real-time data collection, AI-driven analytics, and continuous optimisation. It supports data-driven traffic management, urban planning, emergency response, and sustainability goals, while reducing congestion, improving road safety, and enhancing overall urban mobility efficiency.

Functional Requirements

The use case's functional requirements revolve around measurement accuracy and solution reliability due to the extremely important safety implications that the sensors' measurements have. Moreover, the solution most implement an effective strategy to decide sensing and transmission frequency balancing reporting granularity and battery life. Additionally, an adequate alert system must be set in place.

Market Business Requirements

The market requirements emphasise improved urban mobility outcomes through data-driven decision-making. By providing accurate vehicle classification and real-time traffic insights, the solution reduces congestion, enhances road safety, improves public transport efficiency, and supports environmental sustainability. It enables authorities to optimise infrastructure planning and policies, lowers operational inefficiencies, and delivers long-term economic, social, and environmental value for the city.

Instantiation of Use Case

Use Case 2.1A provides an insight into real-time traffic status within the city of Valencia through deployed 5G-capable radars in conjunction with open data coming for 3rd-party sensors. The radars can collect statistics on detected vehicles and monitor the fluency of the analyzed street. The usage of additional input sources allows to increase the reliability of the measurements and complete a clearer picture of the traffic. The information collected by the radars is transmitted to the COP-PILOT platform where sensor aggregation is managed to obtain the final assessment of the traffic status.

The real benefit in the use case

COP-PILOT gives an opportunity to move from a pure visualization system to be able to easily automate the execution of actions based on the available information. It additionally simplifies the unification of multiple inputs in a scalable manner, providing a unifying management platform. The platform allows us to combine sensors for improved accuracy. Upon detection of events such as traffic jams, re-routing applications can be launched. Additionally, traffic statistics can be made readily available to decision personnel to improve urban planning.

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Use Case 2.1B

Flood warning and mitigation system through radar sensing

Description

This use case intends to implement a flood warning system throughout the deployment of connected radar units WIOTRAD at vulnerable locations of Almussafes and the Industrial Park. The radars will constantly monitor the water level at the sensed locations and report when it surpasses the pre-defined thresholds. By mapping the water levels at the different locations, the evolution of the flood can be tracked, and decisions can be made in real time, for example, regarding evacuation of personnel.

Functional Requirements

The use case's functional requirements revolve around measurement accuracy and solution reliability due to the extremely important safety implications that the sensors' measurements have. Moreover, the solution most implement an effective strategy to decide sensing and transmission frequency balancing reporting granularity and battery life. Additionally, an adequate alert system must be set in place.

Market Business Requirements

The business requirements focus on providing a solution to improve effectiveness when dealing with a flood event. While the solution must be accompanied with other measurements such as adequate prevention, having a real-time monitoring tool for the water level at key locations allows to better coordinate a response and distribute efforts to prevent human and material losses.

Instantiation of Use Case

Use Case 2.1B deals with flood warning and mitigation based on radar sensing. The deployed water level radars periodically measure their floor level and send the information to the platform, where through processing it must be determined if a flood event is occurring and trigger actions in consequence, by discriminating detected levels and possible false positive measurements due to environmental conditions. Additional sources of information will complement the measurements, such as weather reports or meteorological stations' available inputs.

The real benefit in the use case

For critical applications such as the one solved by this use case, a platform that allows to unify multiple inputs and manage the devices in an automated way can lead to reducing decision times and more efficient response to emergencies. The deployment of water level radars in such a dynamic environment as an industrial park benefits from joining multiple sources of information for increased accuracy as well as optimizing report times without compromising battery life of the devices.

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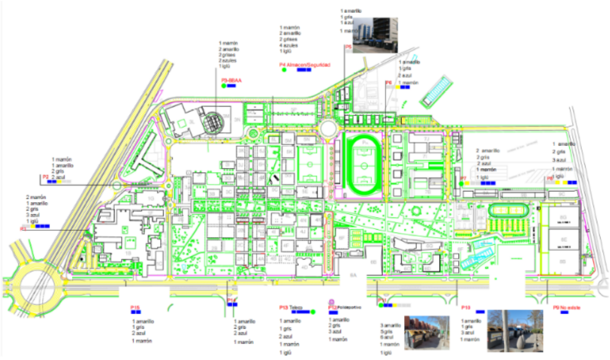
Use Case 2.2

Smart Resources Management in The UPV Campus



Description

This use case aims to establish a smart, data-driven waste management system at the Universitat Politècnica de València (UPV). By deploying fill-level sensors across general waste containers and integrating data into centralized IoT and COP-PILOT platforms, UPV can move from estimated to real-time, accurate monitoring of waste generation. The solution enables continuous visibility, improved environmental impact assessment, and informed decision-making across campus operations.

Functional Requirements

The system must support real-time fill-level sensing, secure data transmission, and integration with Nespra's IoT platform, Thinking Cities, and COP-PILOT. It should enable centralized monitoring, data validation, analytics, visualization dashboards, and reporting. The platform must support scalable deployment, carbon footprint assessment, and data-driven optimisation of container distribution, collection frequency, and routes across a multi-year implementation roadmap.

Market Business Requirements

The business requirements focus on improving operational efficiency and sustainability in campus waste management. Accurate data reduces reliance on external estimates, optimises collection logistics, lowers operational costs, and decreases environmental impact. The solution supports regulatory reporting, sustainability targets, and long-term planning, delivering measurable economic and environmental value while positioning UPV as a leader in smart, sustainable campus management.

Instantiation of Use Case

Use Case 2.2 focuses on resource management within the UPV Campus, utilizing twenty-six NB-IoT-enabled fill-level sensors. These devices transmit real-time telemetry through the NES IoT Agent to the COP-PILOT Orion Data Management component. Overseen by the domain orchestrator, the system manages local data storage and software deployments. The main goal is to monitor and control waste collection and container filling levels, ensuring efficient campus-wide operations through secure, automated IoT sensing pathways and centralized supervision.

The real benefit in the use case

The COP-PILOT system provides a scalable foundation for automating UC2.2, significantly reducing manual oversight. By utilizing the domain orchestrator, it allows for the seamless, automated deployment of software components and the easy integration of diverse information sources. Whether using NB-IoT devices or other hardware types, the system simplifies adding new sensors. All data is unified through a centralized management system using the NGSI-LD protocol, ensuring interoperability. This modularity allows for expansion to other campus areas, different container types, or even city-wide applications.

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Use Case 2.3

Maritime Traffic Monitoring and Berthing Assistance

Description

This use case addresses the growing complexity of vessel traffic management in the Port of Valencia, driven by the arrival of larger container ships. Existing GPS and AIS systems lack the precision needed to determine vessel orientation and occupied space during critical maneuvers. By deploying radars at port entrances and docks and integrating them with existing platforms, the solution enables accurate, real-time tracking of vessel position, direction, and proximity to port infrastructure, improving safety and operational efficiency.

Functional Requirements

The system must support radar-based real-time vessel detection, correlation with AIS data, and precise tracking of vessel position, orientation, and dock proximity. It should integrate with port data sources, TID's platform, and terminal operating systems (TOS), providing visualization, alerts, and KPI monitoring. The solution must ensure low latency, high accuracy, continuous availability, and interoperability across multiple stakeholders and port systems.

Market Business Requirements

The business requirements focus on enhancing port safety, efficiency, and profitability. Improved tracking reduces accident risk, optimizes docking and turnaround times, and supports better resource coordination among port operators, terminals, and shipping companies. By lowering operational delays and infrastructure damage, the solution reduces costs, increases throughput, and strengthens the Port of Valencia's competitiveness as a high-capacity, smart maritime hub.

Instantiation of Use Case

Use Case 2.3 aims to manage the monitoring of maritime traffic in the port of Valencia through the installation of multiple radars which will detect incoming ships and provide berthing assistance in the targeted dock. Triggered by the detection of a ship entering the interest area, a slice will be activated providing docking assistance radars with the required connectivity to report continuous measurements. The radars will report to the platform, where the information provided by other monitoring sources will be integrated.

The real benefit in the use case

COP-PILOT will provide the use case with a platform where actions triggered by the detection of an incoming ship can be easily automated, and multiple sources of information can be combined to improve the day-to-day operations of the port. Moreover, the possibilities of integration with other use cases to evaluate the impact of maritime traffic on the city's mobility and occupancy offer exciting opportunities.

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Use Case 2.4A

IoT-Driven Smart Building Management

Description

This use case focuses on transforming La Harinera, a multipurpose public building managed by the City Council of València, into a smart, data-driven facility. By integrating existing BMS-connected IoT nodes with a cloud platform and deploying new sensors where needed, the solution enables real-time visibility into occupancy, comfort, and energy usage. It replaces estimation-based management with objective data to improve operational efficiency, user comfort, and sustainability.

Functional Requirements

The system must continuously measure and transmit formaldehyde concentrations via LoRaWAN, using a reliable outdoor gateway and secure connectivity to Nespra's IoT platform and CO-PILOT. It should provide configurable alerting (email/SMS) for threshold breaches, low battery, and device disconnections, alongside dashboards, logging, and data storage for analysis. The architecture must ensure high uptime, low latency for critical alerts, secure authentication and encryption, and scalability to add sensors or expand coverage.

Market Business Requirements

TeThe business requirements emphasize improved energy efficiency, reduced operational costs, and enhanced user experience in public buildings. Real-time insights enable proactive facility management, better space utilization, and evidence-based sustainability strategies. The solution delivers long-term value by reducing manual interventions, supporting climate objectives, and establishing a scalable smart-building model that can be replicated across Valencia's municipal infrastructure.xt

Instantiation of Use Case

Use Case 2.4A implements automated capacity tracking across city facilities by deploying advanced people-counting sensors. These units capture and stream occupancy data through specialized IoT agents directly into the COP-PILOT Orion Context Broker. Orchestrated by the domain layer, the architecture facilitates localized data processing and software updates. This setup ensures precise monitoring of building density and room usage, providing a centralized framework for managing campus-wide space allocation through secure and automated digital workflows.

The real benefit in the use case

Leveraging the COP-PILOT platform transforms raw occupancy metrics into actionable insights, removing the reliance on manual headcounts. The system's domain orchestrator simplifies the integration of new sensing hardware and the deployment of analytical tools. By standardizing data via the NGSI-LD protocol, the solution ensures full interoperability with smart building management systems. This modular approach allows for seamless scaling to larger venues, enhancing both operational efficiency and safety protocols across the entire city infrastructure.

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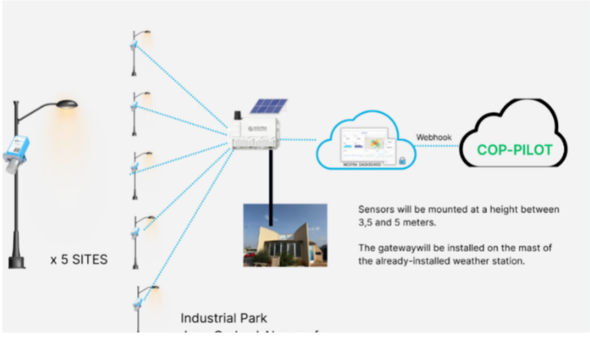
Use Case 2.4B

IoT-Based Environmental Quality Monitoring System



Sensors will be mounted at a height between 3,5 and 5 meters.

The gatewaywill be installed on the mast of the already-installed weather station.

Description

This use case deploys a LoRaWAN-based environmental monitoring network in the Juan Carlos I Industrial Park (Almussafes) to track formaldehyde (HCHO) levels in real time. Five outdoor sensors and a solar-powered gateway feed measurements into Nespra's IoT platform, which integrates with CO-PILOT to support transparent monitoring, rapid alerts, and coordinated emergency response. The solution strengthens industrial safety, reduces health risks, and improves trust across operators, companies, and public authorities.

Functional Requirements

The system must continuously measure and transmit formaldehyde concentrations via LoRaWAN, using a reliable outdoor gateway and secure connectivity to Nespra's IoT platform and CO-PILOT. It should provide configurable alerting (email/SMS) for threshold breaches, low battery, and device disconnections, alongside dashboards, logging, and data storage for analysis. The architecture must ensure high uptime, low latency for critical alerts, secure authentication and encryption, and scalability to add sensors or expand coverage.

Market Business Requirements

The business requirements focus on improving industrial risk management and compliance through continuous, auditable air-quality surveillance. Real-time detection and alerting reduce incident response time, support evacuation and operational continuity, and lower the likelihood and cost of safety events. Transparent reporting strengthens stakeholder confidence, enables proactive environmental governance, and creates a scalable monitoring model that can be replicated across industrial zones to meet safety and sustainability objectives.

Instantiation of Use Case

Within the Almussafes Industrial Park, Use Case 2.4b deploys a network of five LoRaWAN sensors designed for real-time formaldehyde detection. These environmental monitors push concentration data through a dedicated IoT gateway into the COP-PILOT Orion management component. Under the supervision of the domain orchestrator, the infrastructure handles complex data streams and automated software triggers. This deployment focuses on safeguarding industrial environments by establishing a robust, automated pipeline for chemical monitoring and high-level oversight through centralized data management.

The real benefit in the use case

TextThe COP-PILOT framework enhances industrial safety in Almussafes by providing a highly responsive system for air quality control. Its domain orchestrator facilitates the rapid deployment of monitoring modules, making it easier to incorporate diverse chemical probes. By unifying all environmental telemetry through the NGSI-LD standard, the platform ensures that data remains accessible and consistent. This architecture not only streamlines current monitoring tasks but also offers a future-proof model for expanding pollutant detection across broader industrial clusters.

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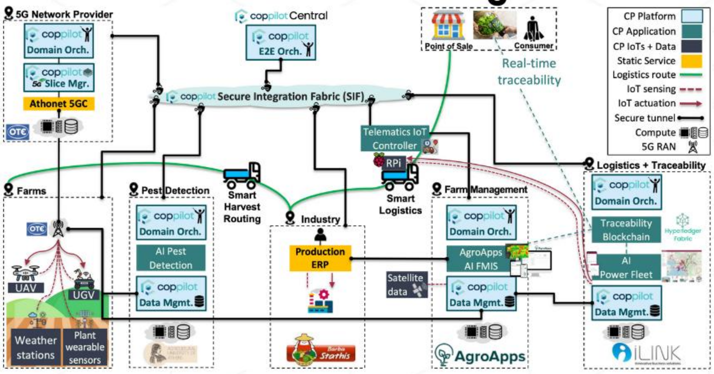
Cluster 3A: AgriTech Transformation and Sustainability Initiative (ATSI)

Use Case Overview Diagram



Ambition, Mission and Objectives

- Enable interoperable, data-driven open-field agriculture by integrating IoT sensing, robotic and aerial platforms, satellite Earth Observation, and digital farm management services over resilient connectivity.
- Enhance agricultural monitoring and decision-making through continuous field data collection, automated scouting, and AI-assisted analytics supporting precision operations.
- Advance sustainable and transparent farming practices by reducing resource inefficiencies and strengthening data traceability and compliance readiness across farm operations.

Description

AgriTech Transformation & Sustainability Initiative (ATSI) addresses the need to modernise European agriculture by integrating digital technologies that enhance productivity, sustainability, and resilience. Focused on leafy vegetable production, the cluster deploys interoperable IoT, edge computing, robotics, and data platforms to enable real-time crop monitoring, precision interventions, and traceable farm-to-fork logistics. Operating within EU Green Deal and CAP objectives, ATSI demonstrates how data-driven agriculture can reduce environmental impact, improve food quality, and strengthen competitiveness across the agri-food value chain.

Pathway to Execution

Execution relies on synchronising agronomic priorities, business value, and technical orchestration. Business alignment is achieved by anchoring use cases to measurable outcomes, input reduction, timelly interventions yield and quality improvement, and traceability, aligned with EU sustainability and market expectations. Technically, execution depends on interoperable architectures that integrate IoT sensors, UAVs, UGVs, FMIS platforms, and blockchain through edge-native orchestration. Continuous coordination between farmers, agronomists, technology providers, and logistics actors ensures that real-time insights translate into timely interventions, scalable deployment, and replicable digital agriculture models across regions and crops.

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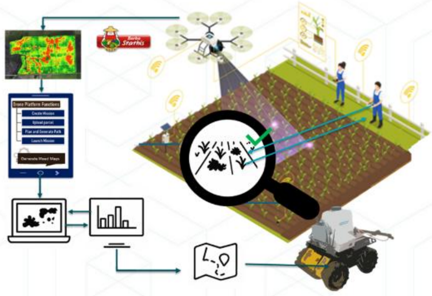
Cluster 3A Use Case Summary

UC 3A.1

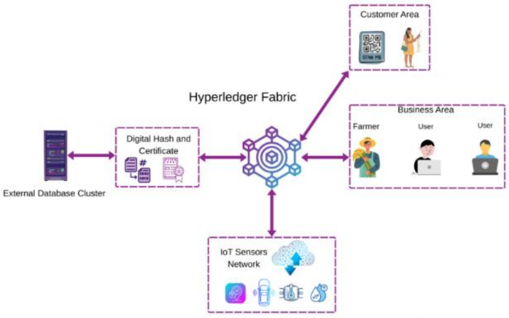
This use case supports precision spinach farming by integrating real-time IoT sensing, UAV imagery, and EO data to enable continuous crop and environmental monitoring, stress detection, and data-driven targeting of field operations, while improving data traceability across farm activities.

UC 3A.2



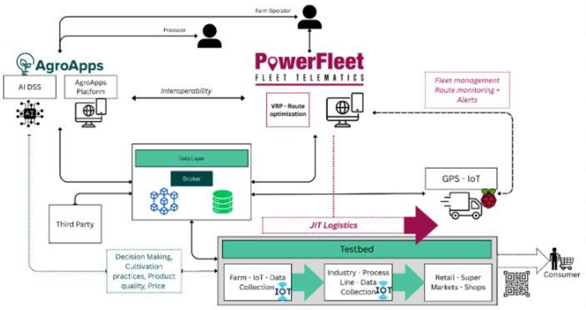
The use case enables autonomous precision weed control by combining UAV monitoring, AI weed detection, and UGV-led spot spraying, reducing chemical inputs while improving field-level sustainability and efficiency.

UC 3A.3



This use case enables secure and interoperable data integration and traceability across the agri-food supply chain, from primary production through processing, logistics, and distribution, by combining federated multi-cloud infrastructures and blockchain-based mechanisms to ensure data integrity, controlled access, and trusted data sharing among stakeholders.

UC 3A.4



This use case enables Just-In-Time logistics for perishable agri-food products by integrating vehicle telematics and AI-based analytics to optimize scheduling and routing, reducing delays, spoilage and operational inefficiencies.

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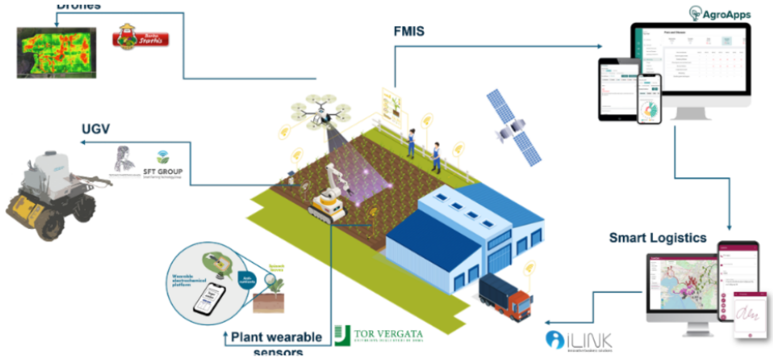
Use Case 3A.1

Integrated Precision Agriculture and Crop Monitoring



Description

This use case enables precision spinach cultivation through continuous crop and environmental monitoring by integrating IoT weather stations, plant-wearable sensors, UAV imagery, and satellite Earth Observation, with UGV support for field scouting. The system detects weed patches, monitors crop stress and antinutrient-related indicators, and delivers data-driven recommendations for field operations through a digital Farm Management Information System (FMIS). Data generated at field level are structured to support traceability and downstream coordination across the agri-food value chain.

Functional Requirements

The system shall register crop parcels and continuously acquire multi-source field data, including weather station measurements, soil and plant-wearable sensor data, UAV imagery, and satellite Earth Observation. It shall process aerial and satellite imagery to generate vegetation indices, detect anomalies and weed zones, and fuse heterogeneous observations into a unified field-level view. The platform shall deliver AI-assisted alerts and operational recommendations within defined response times through a Farm Management Information System (FMIS). It shall support hybrid edge and cloud processing, secure data transmission, role-based access control, and immutable logging of field observations and interventions, including integration with blockchain-based traceability mechanisms. The system shall enable tasking and coordination of UGV field scouting activities and provide interfaces for downstream integration with logistics and Just-In-Time (JIT) transport coordination services.

Market Business Requirements

The business requirements focus on reducing production and operational costs while improving yield consistency, product quality, and stakeholder trust. Early detection, timely and precision field interventions reduce input use and labour effort, limit crop losses, and shorten decision-to-action cycles. Enhanced data traceability, supported by blockchain-backed records, increases buyer confidence and enables access to higher-value markets. Integration with smart and Just-In-Time logistics improves freshness, reduces spoilage and fuel consumption, and delivers measurable return on investment through a scalable model for sustainable leafy-vegetable production.

Instantiation of Use Case

UC3A.1 enables real-time crop and environmental monitoring through IoT sensors, wearable plant sensors, UAV imaging, and satellite data. Within COP-PILOT, heterogeneous data streams are securely ingested via the SIF and processed in the DDOL, where EO, IoT, and UAV inputs are fused into unified crop intelligence services, enabling parcel-level analytics and continuous situational awareness.

The real benefit in the use case

By leveraging COP-PILOT's data fusion and orchestration capabilities, the use case delivers near real-time insights and early warning mechanisms that would not be achievable with fragmented systems. This results in faster, more accurate decision-making, reduced input use, and improved yield performance through coordinated, data-driven interventions.

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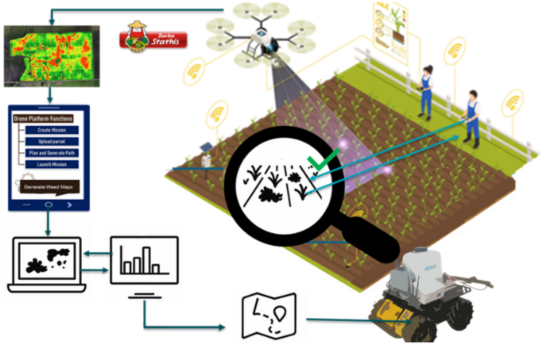
Use Case 3A.2

Advanced Agri-robotics For Autonomous Intervention



Description

This use case enables autonomous precision weed control in spinach cultivation by combining UAV-based field monitoring with AI-driven analysis and UGV-led spot spraying. Multispectral UAV imagery is processed to detect and map weed pressure. When thresholds are exceeded, autonomous UGVs validate infestations on site and execute targeted spraying, with results logged in the FMIS to reduce chemical use and improve sustainability.

Functional Requirements

The functional requirements for this use case are that the system must register the crop parcel in the FMIS, execute scheduled UAV missions, process UAV imagery into orthomosaics and classified weed maps. It must quantify weed cover percentage and apply threshold logic to determine when intervention is required, then transmit mission commands and geo-referenced treatment zones to the UGV via the orchestration layer. The UGV must autonomously navigate to target areas, capture and locally process visual data at the edge to validate and refine recommendations, and support a human confirmation step before execution. After spot spraying, the system must record action logs (treatment type, location, timestamp, operator identity, and dose) and upload mission results to the FMIS for traceability, reporting, and future optimisation.

Market Business Requirements

The market and business requirements focus on faster weed detection and action, reduced herbicide use, and lower labour costs through automation. The solution should enable rapid detection-to-intervention cycles, support precise spot spraying per weed patch, and replace manual scouting with UAV–UGV operations. It must be scalable and interoperable, with edge processing to minimise latency and auditable records to support compliance and commercial adoption.

Instantiation of Use Case

UC3A.2 deploys AI-enabled UGVs to perform targeted interventions such as precision spraying, based on real-time inputs from sensors and UAVs. Within COP-PILOT, the DDOL orchestrates decision triggering and coordination between sensing and actuation layers, ensuring seamless integration and real-time communication across components.

The real benefit in the use case

Through COP-PILOT's real-time orchestration and edge-to-cloud integration, the use case enables fully automated and synchronised interventions (UAV & UGV informed), significantly improving responsiveness and accuracy. This leads to reduced chemical inputs, optimised resource use, and increased operational efficiency compared to traditional mechanical solutions and uniform applications.

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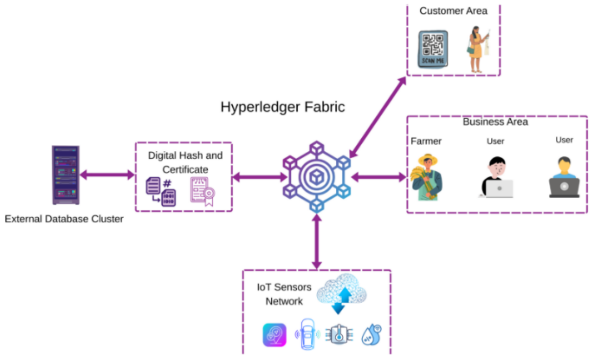
Use Case 3A.3

Secure Data Management and Interoperability



Description

UC3A.3 enables secure, trusted, and interoperable data sharing across the agri-food value chain using a federated multi-cloud architecture and blockchain-based traceability. By immutably recording cultivation, packaging, transport, and storage events, this use case ensures end-to-end visibility, regulatory compliance, and verifiable provenance from farm to consumer. The solution transforms traceability from a static compliance tool into a real-time, trusted digital service that supports automation, transparency, and collaboration across stakeholders.

Functional Requirements

The functional requirements focus on securely capturing, signing, and storing agri-food lifecycle events on a permissioned blockchain. The system must register harvested batches, log packaging and certification data, ingest telemetry from IoT sensors, and expose traceability information via QR codes. It shall support role-based access control, low-latency data exchange, and orchestration triggers for SLA deviations, ensuring integrity, auditability, and interoperability across platforms.

Market Business Requirements

The market requirements emphasize cost-effective compliance, scalability, and value creation through verifiable provenance. The solution must reduce certification and auditing costs, simplify onboarding for new partners via standard APIs, and support expansion into ESG-driven and premium markets. By delivering trusted, tamper-proof traceability with low operational overhead, this use case enhances brand value, consumer confidence, and competitiveness across agri-food supply chains.

Instantiation of Use Case

UC3A.3 enables secure and interoperable data exchange across the agri-food value chain through encryption, Hyperledger Fabric blockchain infrastructure, and standardized data models. Within COP-PILOT, the SIF supports trusted data integration and exchange, while the DDOL manages orchestration, access control, and interoperability across distributed systems.

The real benefit in the use case

By building on top of COP-PILOT's Secure Integration Fabric and orchestration layer, the use case ensures trusted, end-to-end data flows across stakeholders and systems. This enhances data reliability, enables verifiable, tamper-proof traceability, and supports the deployment of cross-domain services that depend on secure and interoperable data sharing.

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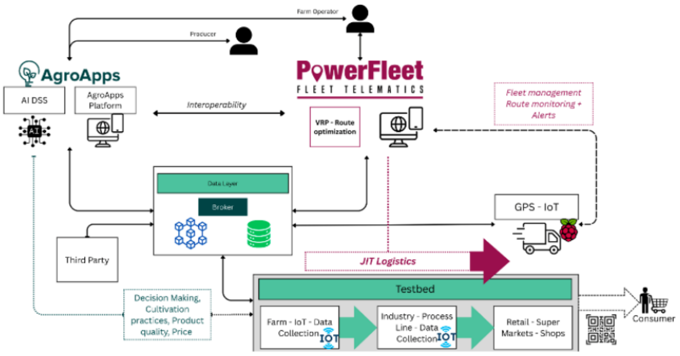
Use Case 3A.4

Smart Logistics and Supply Chain Optimisation



Description

This use case enables real-time, freshness-aware logistics for perishable produce using telematics from refrigerated vehicles (GNSS, temperature, humidity, cargo status). An AI-driven orchestration layer continuously estimates freshness and dynamically adjusts routing, priorities, and dispatch plans when risks (delays, temperature excursions, SLA breaches) are detected. The outcome is improved JIT delivery, reduced spoilage, and better transport resource utilisation across the agri-food supply chain.

Functional Requirements

The system must collect and transmit real-time telemetry from field and vehicle sensors, trigger route optimisation and vehicle dispatch via PowerFleet, and integrate with the COP-PILOT orchestration layer through secure APIs. It must log key harvesting/transport/packaging events (and related metadata) on the blockchain, and provide consumer-facing traceability via QR codes. The platform must support event-driven re-routing when freshness thresholds/SLA conditions are violated, with secure authentication and encrypted communications.

Market Business Requirements

TextUC3A.4 must deliver measurable cost and performance gains: lower cost per delivery through dynamic routing and higher fleet utilization, faster onboarding and integration via modular APIs/connectors, and high operational resilience through failover and continuity mechanisms. It should enable service differentiation (freshness-aware delivery orchestration as a service), support scalability to new actors/regions, and protect commercial value by reducing spoilage, delays, and SLA penalties.

Instantiation of Use Case

UC3A.4 optimizes harvesting and logistics operations through Just-In-Time coordination, leveraging real-time field data, predictive analytics, and the Power Fleet telematics platform. Within COP-PILOT, the DDOL orchestrates data flows between field intelligence, Agro Apps 360 (FMIS), and refrigerated transport fleets, while the SIF ensures secure interoperability across all actors involved.

The real benefit in the use case

Leveraging COP-PILOT's end-to-end integration and real-time data exchange, the use case enables synchronized decision-making between primary production, AgriFood processing and logistics activities. This results in improved planning accuracy, reduced delays and losses, and more efficient, responsive supply chain operations compared to conventional, disconnected systems.

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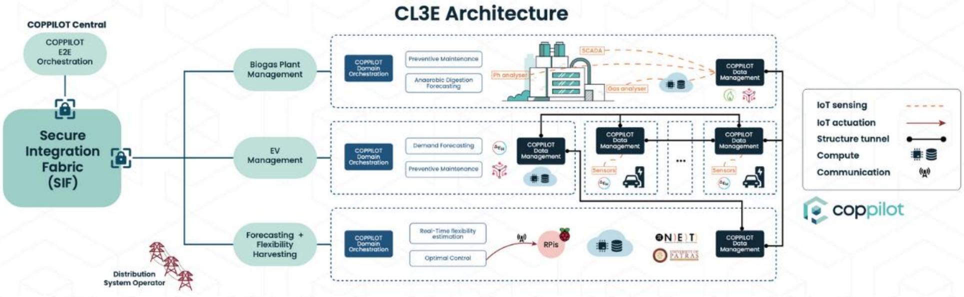
Cluster 3E: Edge Intelligence For Enhancing Grid Reliability In RES - Rich Distribution Grids

Use Case Overview Diagram



Ambition, Mission and Objectives

- Enable real-time integration of distributed renewable energy sources and flexible loads within active distribution grids using edge intelligence and secure orchestration.
- Demonstrate scalable, automated energy services across laboratories, EV charging networks, and biogas plants, improving reliability, flexibility, and operational efficiency.
- Transition from fragmented, reactive energy operations to proactive, data-driven, and interoperable grid management models that support resilience and decarbonisation.

Description

Smart & Resilient RES-Rich, Cross-Sector Coupled Distribution Grids focuses on enhancing energy system resilience and efficiency in Western Greece through coordinated edge–cloud intelligence. The cluster integrates active distribution grids, EV charging infrastructure, and a biogas power plant into a distributed yet interconnected ecosystem. Using advanced ICT, IoT sensing, and predictive analytics, it enables real-time flexibility harvesting, predictive maintenance, and energy forecasting. The cluster demonstrates how cross-sector orchestration can reduce operational costs, improve reliability, and support low-carbon, renewable-rich distribution networks.

Pathway to Execution

Execution depends on synchronising energy-sector business goals with distributed digital infrastructure. Business alignment focuses on measurable outcomes such as grid resilience, reduced downtime, lower operational costs, and improved flexibility market participation. Technically, this requires interoperable cloud-edge architectures, low-latency connectivity, and secure orchestration of analytics and control services across heterogeneous assets. Continuous coordination between grid operators, infrastructure owners, and technology providers ensures that real-time analytics, predictive maintenance, and flexibility control are deployed reliably, scaled across sites, and translated into operational and economic value.

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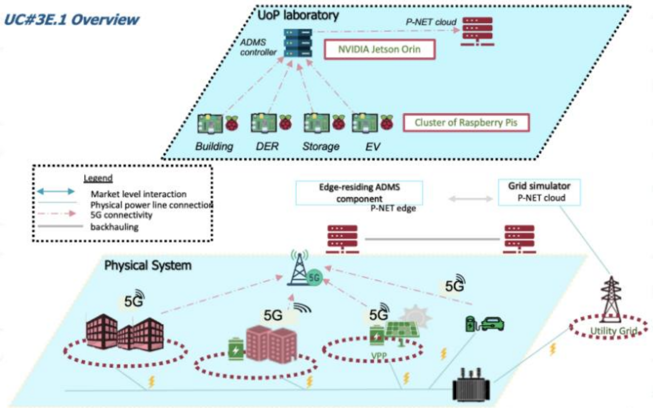
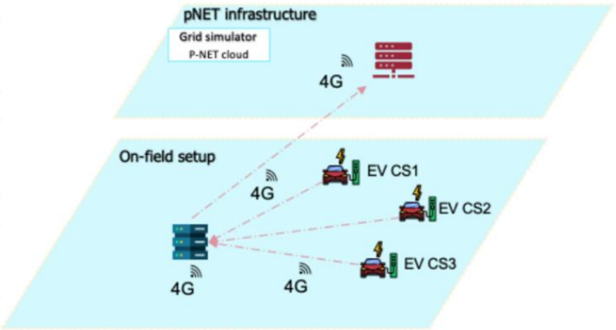
Cluster 3E Use Case Summary

UC 3E.1



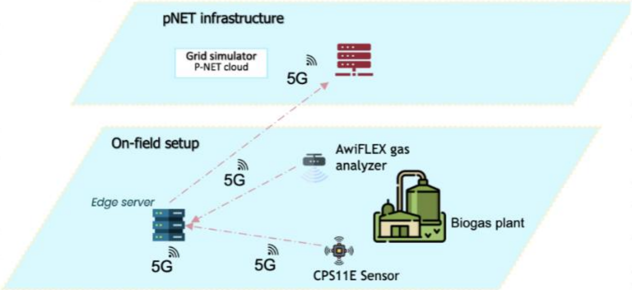
DescriptionThis use case shows a cloud–edge platform enabling real-time, low-latency flexibility management in active distribution grids.

UC 3E.2



The use case uses edge-enabled analytics and AI to monitor EV fast-charger health, forecast demand, reduce downtime, and optimize power use.

UC 3E.3



Use case 3E.3 uses real-time monitoring and predictive analytics to improve biogas plant reliability, stabilise output, and reduce unplanned downtime.

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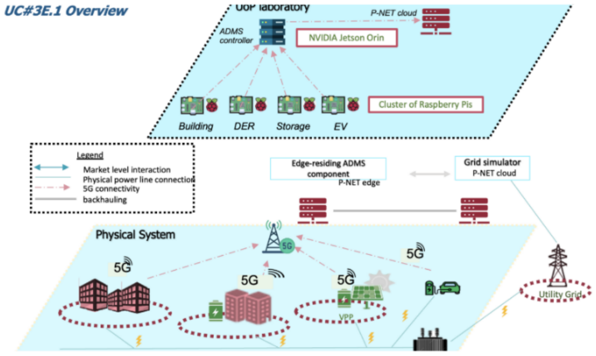
Use Case 3E.1

Ensuring Uninterruptible Power Supply For Fast EV Chargers



Description

This use case demonstrates a cloud–edge platform for real-time flexibility management in active distribution grids under laboratory conditions. It integrates continuous flexibility estimation with optimal control of distributed energy resources, including loads, generation, and storage. Real-time telemetry is processed at the edge to enable low-latency decisions, while cloud services support analytics training and orchestration. By emulating realistic grid scenarios, the use case validates automated, data-driven flexibility services such as voltage regulation and demand response, providing a scalable blueprint for future field deployment.

Functional Requirements

The system must continuously estimate available grid flexibility from distributed energy resources with a short refresh cycle and monitor grid constraints in real time. It must dynamically coordinate DERs to deliver flexibility services, executing analytics and control logic on edge devices to ensure sub-second responsiveness. Reliable, low-latency communication between far-edge, edge, and cloud layers is required, using standard energy protocols for interoperability. The platform must also support realistic grid simulation and seamless orchestration of microservices across the cloud–edge continuum.

Market Business Requirements

From a market perspective, the solution must reduce the cost and complexity of flexibility deployment for distribution system operators by enabling automated, real-time control rather than manual intervention. It should support scalable integration of additional DERs and grid areas without major infrastructure changes, improving return on investment. The platform must enhance operational efficiency and reliability, enabling new flexibility-based services and local energy market participation. By lowering entry barriers and supporting standardized interfaces, the use case strengthens commercial viability and adoption potential across diverse grid environments.

Instantiation of Use Case

Use Case 3E.1 focuses on real-time flexibility management within UoP's laboratory environment, utilizing a cloud-edge computing infrastructure and the COP-PILOT platform to orchestrate distributed energy resources. Sensor data from far-edge devices — alongside real DER and load data from Use Cases 3.2 and 3.3 — flows through FIWARE IoT Agents into the Orion Context Broker and MongoDB, where AI models drive flexibility estimation and optimal DER control. Overseen by the COP-PILOT domain orchestrator, the system operates through secure 5G/6G communication channels and standardized protocols including IEC 61850.

The real benefit in the use case

Leveraging the COP-PILOT system, fragmented isolated algorithms are unified into a real-time orchestration platform, improving cross-site coordination across distributed energy resources. It enriches flexibility estimation algorithms with real operational data from active field deployments, improving their accuracy. Most importantly, it enables bidirectional communication between system operators, DERs, and controllable loads, transforming grid interaction from passive monitoring into an active, closed-loop control environment.

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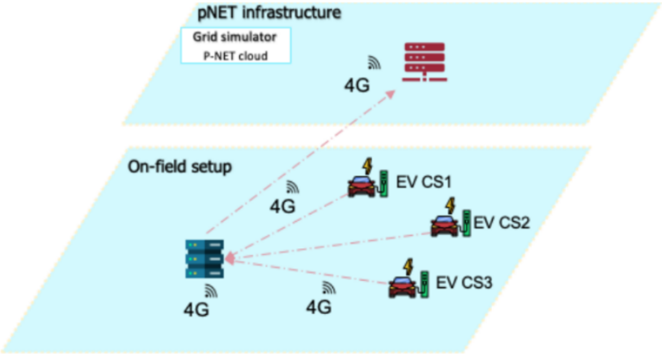
Use Case 3E.2

Ensuring Uninterruptible Power Supply For Fast EV Chargers



Description

This use case focuses on improving the reliability and intelligence of highway EV DC fast-charging infrastructure through edge-enabled analytics. It combines high-resolution sensing with local AI to monitor charger health and forecast demand in real time. By deploying predictive maintenance and per-charger load forecasting directly at the edge, the system minimizes downtime, optimizes power allocation, and enhances user experience. The solution strengthens charging network resilience, supports grid-aware operation, and contributes to the broader objective of accelerating large-scale EV adoption.

Functional Requirements

The system must collect and process high-resolution voltage and current data from inductive sensors at each charging point in real time. It must execute predictive maintenance algorithms at the edge to detect early signs of hardware degradation and generate timely alerts. The platform must also forecast short-term energy demand per charger to support dynamic power management. Reliable, low-latency communication between sensors, edge devices, and orchestration layers is required, along with automated service deployment and operator notification through centralized dashboards.

Market Business Requirements

From a market perspective, the solution must reduce operational costs by shifting maintenance from reactive to predictive and by minimizing unplanned charger downtime. It should increase charger availability and customer satisfaction, strengthening operator competitiveness in a rapidly growing EV market. The architecture must support scalable deployment across large charging networks with minimal integration effort, enabling fast time-to-market. By improving energy efficiency and grid coordination, the use case also creates value for utilities and supports sustainable, commercially viable EV charging services.

Instantiation of Use Case

Use Case 3E.2 focuses on high-performance EV fast charging reliability, utilizing high-resolution inductive sensors and NVIDIA Jetson-based edge AI units to enable predictive maintenance and demand forecasting. Sensor data flows through FIWARE IoT Agents into the Orion Context Broker and MongoDB, where AI models are trained and inferenced to detect anomalies and forecast load. Overseen by the COP-PILOT domain orchestrator, the main goal is to maximize charging network uptime through local edge processing and seamless scalability.

The real benefit in the use case

Leveraging the COP-PILOT system, reactive site-level maintenance evolves into a unified platform capable of remotely monitoring EV charging fleets at scale. It simplifies aggregation of high-resolution sensor streams across multiple stations, reducing data transfer overhead and operational costs. By enabling predictive maintenance algorithms to identify faults before they cause downtime, it shifts operations from failure response to proactive intervention, ensuring reliable service for EV drivers.

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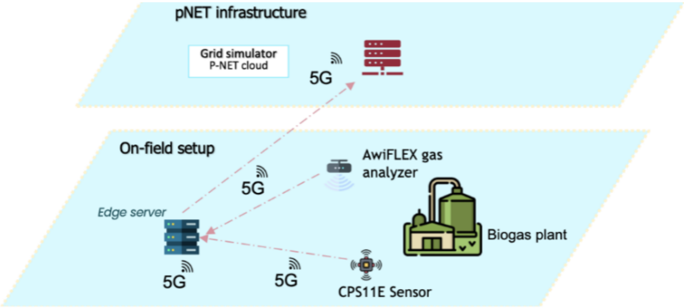
Use Case 3E.3

Predictive Maintenance and Monitoring of Anaerobic Digestion In A Biogas Plant



Description

This use case improves the reliability and output of the Preveza biogas plant by adding continuous monitoring and predictive maintenance to the anaerobic digestion (AD) process. Real-time sensing tracks key stability indicators such as pH, temperature, feedstock conditions, and gas composition, while analytics anticipate equipment wear and process deviations early enough to plan interventions. The system also forecasts electricity production so grid operators can better schedule dispatchable renewable power. Overall, it reduces unplanned downtime, stabilises biogas quality, and increases plant contribution to grid resilience.

Functional Requirements

The system must continuously collect and process AD telemetry, including CH_4, CO_2, O_2, H_2S and pH, and integrate plant sensors with an edge gateway via Modbus. It must execute edge microservices for (i) process forecasting and (ii) predictive maintenance with at least 24 hours lead time for fault risk. When anomalies are detected, it must generate automated alerts and deliver insights through an operator dashboard showing real-time trends and diagnostics. All data transfers between sensors, gateway, and edge server must be encrypted and handled securely end to end.

Market Business Requirements

The solution must lower total operating cost by reducing reactive maintenance, preventing avoidable failures, and minimising revenue loss from outages. By increasing uptime and stabilising electricity output, the plant becomes a more dependable, dispatchable renewable asset—improving its value to grid operators and strengthening participation in a decarbonised energy mix. The architecture should be replicable across similar biogas facilities with limited retrofit effort, supporting a scalable predictive-analytics service model. Improved yield and reduced methane leakage risk also strengthen ESG performance and stakeholder confidence in biomass-based energy.

Instantiation of Use Case

Use Case 3E.3 focuses on improving the reliability of the Preveza Biogas Plant, utilizing high-precision instrumentation — including the AwiFLEX gas analyzer and Memosens CPS11E pH sensor — to monitor the anaerobic digestion process. Sensor data flows through FIWARE IoT Agents into the Orion Context Broker and MongoDB, where AI models support predictive maintenance and electricity production forecasting. Overseen by the COP-PILOT domain orchestrator, the goal is to transition the plant to a smart, data-driven operation.

The real benefit in the use case

Leveraging the COP-PILOT system, manual experience-dependent monitoring transitions to a smart, automated facility with continuous real-time visibility into the anaerobic digestion process. It enables accurate electricity production forecasting for better grid integration and supports circular economy goals through transparent use of organic waste resources. By anticipating equipment degradation before failures occur, it significantly reduces unplanned downtime and operational costs.

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Cluster 4: Smart Vineyards and Sustainable Winery Ecosystems

Use Case Overview Diagram

Ambition, Mission and Objectives

- Integrate smart vineyard, winery production, and IoT lifecycle management into a unified, interoperable digital ecosystem.
- Improve water efficiency, production performance, and operational visibility while reducing environmental footprint and electronic waste.
- Demonstrate scalable, EU-sovereign, and replicable digital solutions for sustainable viticulture and agri-food production.

Description

Smart Vineyards & Sustainable Winery Ecosystems demonstrates how IoT, AI, and ML can enable digital transformation across viticulture, winery production, and sustainability operations. Operating within an IoT–Edge–Cloud continuum, the cluster integrates smart vineyard management, optimized winery production lines, and circular lifecycle management of IoT devices. By unifying heterogeneous data sources and operational requirements, it validates scalable, GDPR-compliant solutions that improve resource efficiency, reduce environmental impact, and support circular economy principles within a representative vineyard–winery ecosystem.

Pathway to Execution

Execution relies on synchronising sustainability-driven business goals with technical orchestration across vineyards, wineries, and supporting partners. Business alignment focuses on measurable outcomes such as water savings, energy efficiency, reduced downtime, and circular reuse of IoT assets. Technically, execution depends on federated data management, open interfaces, and automated orchestration across the IoT–Edge–Cloud continuum. Continuous coordination between vineyard operators, winery managers, technology providers, and recycling partners ensures secure data governance, scalable deployment, and the translation of pilot results into replicable, market-ready solutions aligned with ESG objectives.

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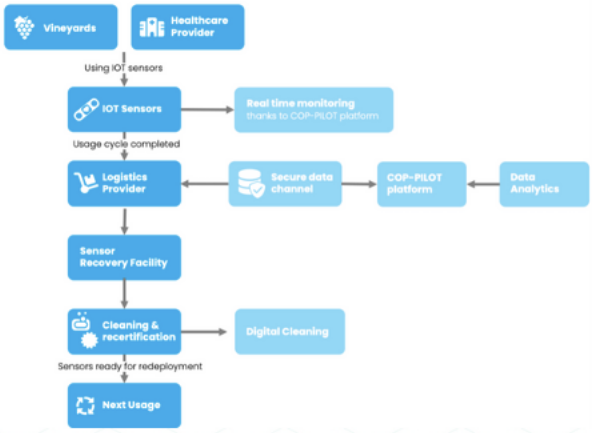
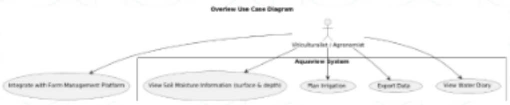
Cluster 4 Use Case Summary

UC 4.1



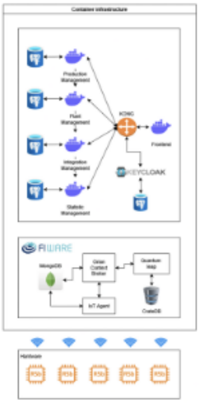
This use case shows a cloud–edge platform enabling real-time, low-latency flexibility management in active distribution grids.

UC 4.2



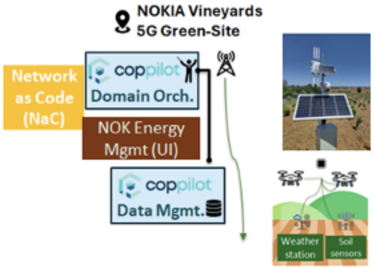
Aquaview is a sensorless soil-moisture system using satellite and weather data to provide high-resolution maps, predictions, and virtual moisture readings, helping optimise irrigation, reduce costs, and protect soil health.

UC 4.3



The IoT Wine Platform use case digitises a winery bottling line with real-time monitoring, anomaly detection, and predictive maintenance, unifying machine and system data to improve efficiency, reduce downtime, and support compliant, data-driven decisions.

UC 4.4



The AI-Driven Green Energy Vineyard Management Use Case is aware of energy use for each deployed and activated device on efficient sites and optimizes the efficient management of the energy in environments powered with batteries connected to green energy sources. The automated control of switch-on or switch-off of the deployed devices will integrate external data sources as weather forecast to optimize energy.

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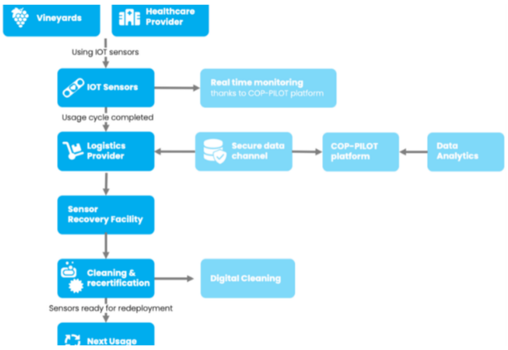
Use Case 4.1

Recycling, Maintenance, and Logistics of IoT Sensors



Description

This use case improves the sustainability and lifecycle management of reusable IoT sensors across healthcare, vineyards, and industrial environments. Using the COP-PILOT platform and RedZinc's DIRP, it enables a closed-loop process for monitoring, recovery, reuse, and recycling, reducing e-waste, lowering costs, and ensuring regulatory compliance.

Functional Requirements

The use case requires a cloud-based, sovereign deployment that supports end-to-end IoT sensor lifecycle orchestration. Core functional requirements include a browser-based dashboard, centralized sensor registration with unique identifiers, and a logistics engine capable of tracking multiple lifecycle events per usage cycle. The system must support automated triggering of collection, cleaning, re-certification, and recycling workflows, alongside optional features such as real-time status tracking, digital cleaning certificates, and visibility through an IoT wallet. Secure integration with COP-PILOT ensures interoperable monitoring, predictable maintenance scheduling, and compliant data exchange across healthcare and agricultural environments.

Market Business Requirements

From a market perspective, the use case targets measurable cost reduction, scalability, and operational efficiency. It aims to reduce IoT procurement and maintenance costs by at least 30% through sensor reuse and predictive maintenance, while lowering integration and operational overhead via standardized orchestration workflows. The solution is designed to be scalable and replicable across multiple sectors and EU regions, with validation in at least three countries. By enabling high sensor reuse rates, lifecycle transparency, and reduced e-waste, the use case supports strong ESG value propositions and establishes a commercially viable, circular IoT asset management model applicable beyond healthcare and viticulture.

Instantiation of Use Case

For the 4.1 use case, we create a COP-PILOT-enabled service for the monitoring, maintenance, replacement, and recycling of IoT sensors deployed in vineyard and related operational environments. Sensor measurements and lifecycle signals (e.g. battery low, fault, end-of-use) are collected and translated into FIWARE/NGSI-LD entities, then securely managed through the COP-PILOT platform. The COP-PILOT orchestrator supports the deployment of the RedZinc lifecycle services and their integration with the Secure Integration Fabric and euID-compatible digital wallets, enabling real-time tracking of sensor condition, automated trigger generation, and coordinated recovery or recycling workflows across suppliers, users, and logistics actors.

The real benefit in the use case

Use case 4.1 benefits from COP-PILOT by turning IoT sensor lifecycle management into an interoperable, secure, and scalable service rather than a standalone workflow. COP-PILOT provides the orchestration, FIWARE-based interoperability, secure data exchange, and euID wallet integration needed to automate maintenance and recycling processes across distributed environments. This enables better traceability, lower replacement costs, reduced e-waste, and stronger compliance with GDPR and EU data sovereignty principles, while also making the solution reusable across vineyards, wineries, and other IoT-intensive sectors.

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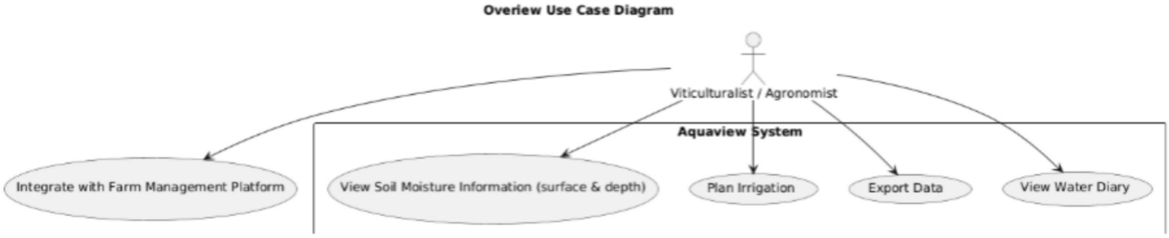
Use Case 4.2

Water Utilisation Efficiency



Description

Aquaview is a sensorless soil-moisture intelligence system designed to improve water utilisation efficiency in agriculture. It combines satellite imagery with historical and forecast weather data to generate high-resolution (≈30 m radius) topsoil moisture maps, depth moisture estimates (via ML), and 7–14 day moisture predictions. Users define an area of interest and receive daily updates, alerts, and a “virtual moisture probe” reading for any point on their land, plus trends back to 2013. The goal is to optimise irrigation, cut costs, and protect soil health.

Functional Requirements

The solution must acquire remote and on-site inputs and turn them into actionable irrigation insights. It must download and process satellite data and capture supporting in-field measurements for calibration where available. It must compute topsoil moisture content and present results through interactive visualisation, including sector-by-sector moisture mapping within the user’s area of interest. It must also support irrigation planning by providing a timeline view of moisture retention trends over the past ten years, alongside current conditions and near-term predictions, so growers can decide when and where irrigation is required.

Market Business Requirements

For market adoption, Aquaview must deliver clear economic value versus sensor-heavy alternatives while scaling across regions. It must reduce long-term operational costs by at least 30% compared with traditional probe-based irrigation approaches, largely by minimising hardware deployment and associated maintenance. The system should be modular and scalable for expansion into new agricultural domains and geographies, demonstrating successful implementation in at least two countries with minimal configuration. It must also keep maintenance cost-effective through automated diagnostics, updates, and robust backup/failover mechanisms that enable ≥95% automated recovery from data failures.

Instantiation of Use Case

For the 4.2 use case, we create an edge-to-cloud system to optimize irrigation in agricultural parcels. We are using or installing soil moisture IoT sensors which data acquisition is directly fed into our soil moisture estimation model so that we get real-time data insights which is helping to produce a better soil moisture estimate. This captured real-time data from sensors are processed on the edge device available in the farm before being securely transmitted to the FIWARE Orion Context Broker. The COP-PILOT orchestrator automates the deployment of those services either on the edge or on the cloud to ensure a seamlessly processing of the field information to obtain a soil moisture map which helps growers to take decisions about their irrigation plan.

The real benefit in the use case

Use case 4.2 aims to develop a multi-layer orchestrated infrastructure managing collaborative services across distributed and heterogeneous environments, supporting IoT and edge devices in its Aquaview solution. It benefits from the automated IoT-to-cloud continuum tool for scalable deployment, large-scale pilot infrastructures, and cross-sector use cases to develop an accurate solution for growers. Aquaview contributes to COP-PILOT aims not only by demonstrating sustainable water management but also focuses on market validation, sustainability impact, and promoting adoption through standardization and dissemination, showcasing the platform’s practical and scalable potential.

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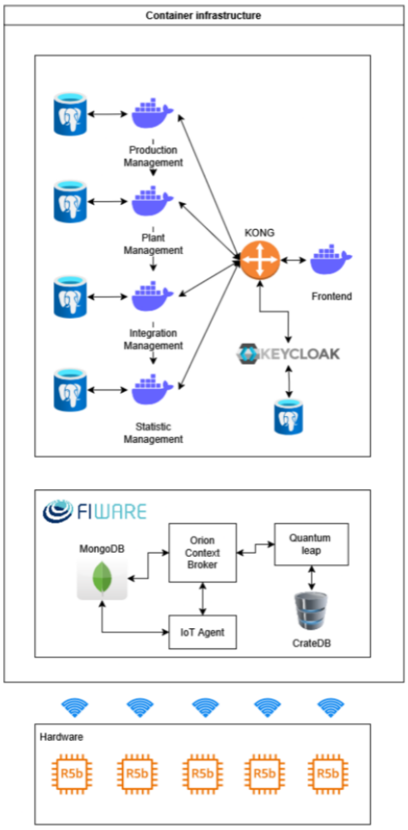
Use Case 4.3

Sustainable Optimised Winery Production Lines

Description

The IoT Wine Platform use case focuses on digitally transforming a winery's bottling line by enabling real-time monitoring, anomaly detection, and predictive maintenance. Through the deployment of IoT sensors, edge devices, and COP-PILOT orchestration, data from industrial machinery, operators, ERP, and MES systems is unified into a single interoperable platform. This provides end-to-end visibility across all bottling stages, reduces downtime, improves operational efficiency, and supports data-driven decision-making while ensuring EU data sovereignty and GDPR compliance.



Functional Requirements

Real-time sensor data capture, ERP/MES integration, NGSI-LD data exchange, OEE calculation/reporting, anomaly detection with alerts, interactive dashboards, historical analysis, and scalable edge-to-cloud orchestration with low latency and high availability.

Market Business Requirements

The market business requirements aim to ensure cost efficiency, scalability, and interoperability for widespread adoption in the wine sector. The solution must significantly reduce operational costs by minimizing manual work, downtime, and production losses through automation and predictive maintenance. It should integrate seamlessly with existing winery systems, support modular expansion to other production processes, and offer a replicable model for other agri-food industries. Long-term value creation is driven by improved productivity, reliability, and competitiveness.

The real benefit in the use case

By applying this architecture within the COP-PILOT system, the primary value-add lies in transforming a traditionally manual and fragmented wine production process into an agile, data-driven ecosystem. Consolidating heterogeneous data sources—ranging from automated sensor readings to calculated Overall Equipment Effectiveness (OEE) metrics and manual operator inputs—into a unified overview empowers production supervisors to make rapid, informed decisions. This real-time visibility enables immediate anomaly detection and triggers automated alerts before minor deviations result in costly downtime. Furthermore, this system is projected to reduce manual data entry intervention by twenty percent and significantly decrease operational human errors. Beyond immediate operational efficiency, this seamless orchestration ensures our data processing remains fully compliant with EU digital sovereignty and GDPR standards, proving that advanced digital transformation in the wine industry can be both highly sustainable and secure.

Instantiation of Use Case

To set up this use case, we are deploying a hybrid edge-cloud infrastructure to achieve comprehensive, real-time control over the winery's bottling operations. We install IoT sensors connected to Raspberry Pi edge devices directly along the production line to monitor critical machinery, including labellers, capsule machines, and ABB robots. These edge devices capture real-time data and securely transmit it via RabbitMQ to a centralized platform. From there, the COP-PILOT orchestrator automates the deployment of services and configures the necessary IoT agents, seamlessly normalizing the data into an NGSI-LD format for the FIWARE Orion Context Broker. This automated orchestration integrates the live sensor feeds with our enterprise systems, such as ERP and MES, and routes historical data into QuantumLeap and CrateDB. Ultimately, this architecture establishes the foundation for advanced trend analysis and predictive maintenance without the need for manual, server-by-server configuration.

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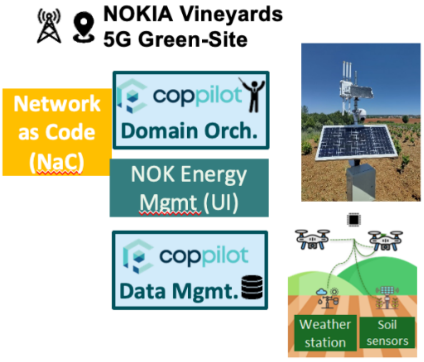
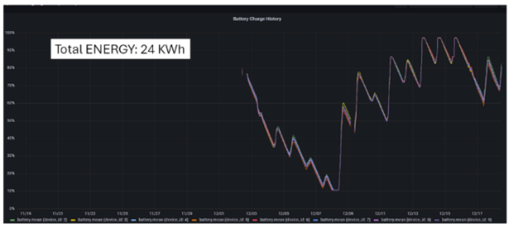
Use Case 4.4

AI Driven Green Energy Vineyard Management





Description

Green Energy management in isolated locations is critical for services deployments when is the only energy available. The accounting of energy use for each deployed and activated device on efficient sites is key for service availability. The 5G/6G connectivity is critical for services deployment, so the efficient management of the energy associated to communications is mandatory. The remote control of switch-on or switch-off the deployed devices will guarantee the optimization of the available energy to use just what is needed optimizing the energy use Integration of future available energy will be also supported taking as input weather forecast

Functional Requirements

Collect the energy use of devices using site energy. Collect energy available on the batteries of the site.Generate energy available forecast on the site taking external weather forecast information. Integrate remote control of energy switch-on or switch-off of any device on the site. Integrate the remote control of energy switch-on or switch-off of mobile network radio layers on the area. Train algorithms to optimize the efficient use of the available green energy for the overall site. Collect and store IoT weather and soil; stations already deployed in the area. Integrate the provision and management of new mobile network: connected devices with several profiles and QoS.

Market Business Requirements

The solution must enable continuous service availability in remote or off-grid environments by optimizing renewable energy usage across deployed devices. It must monitor real-time energy production, storage, and consumption to ensure efficient allocation for critical telecom infrastructure such as 5G and future 6G systems. To reduce operational costs and improve sustainability, the solution must apply forecasting and AI-based optimization to match expected renewable energy supply with service demand. Using external: weather data and predictive analytics, it must enable proactive energy planning, prioritization of devices, and reduced reliance on backup power

Instantiation of Use Case

For the 4.4 use case, we implement an intelligent energy management system for rural and off-grid telecom infrastructures, integrating renewable energy sources, battery storage systems, and 5G network equipment. Real-time data from energy production, storage, and consumption are collected through IoT sensors and normalized into FIWARE/NGSI-LD entities. These data streams are processed at the edge and securely transmitted to the FIWARE Orion Context Broker. The COP-PILOT orchestrator enables automated deployment and lifecycle management of energy-aware services across edge and cloud environments, incorporating weather data and forecasting models to support predictive energy optimization and dynamic decision-making, such as switching 5G radio equipment on/off and relocating applications based on energy availability.

The real benefit in the use case

The benefits from COP-PILOT by enabling a fully orchestrated, interoperable, and AI-driven energy optimization framework. It ensures continuous service availability in energy-constrained environments while reducing operational costs and energy waste. The platform supports proactive energy planning, device prioritization, and automated responses to energy fluctuations, significantly reducing reliance on backup power sources. Additionally, it enhances sustainability, resilience, and scalability of telecom infrastructures, while ensuring compliance with EU data sovereignty and enabling replication across similar rural and off-grid scenarios for future 5G and 6G deployments.

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4 BUSINESS MODEL AND ARCHITECHTURE

4.1 COP-PILOT SERVICE MODEL ECOSYSTEM AND REQUIREMENTS

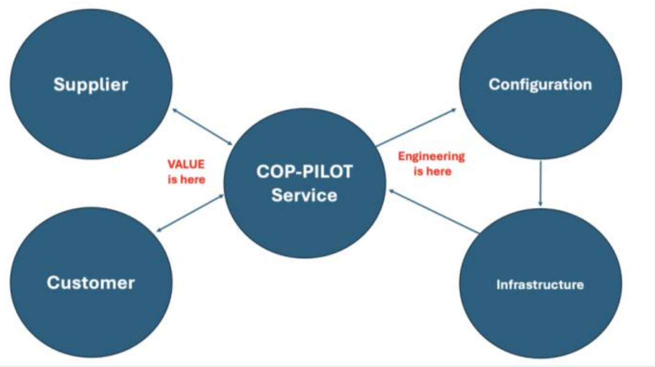

Figure 3: COP-PILOT Service Model – Business and Configuration view

This COP-PILOT Service and Value Model is a structured framework that captures how the platform generates tangible benefits across EU industries by balancing two critical dimensions: Value and Engineering. The model positions Suppliers and Customers as the two interconnected ends of the ecosystem, emphasising that successful deployment requires robust technical configurations and advanced IT systems as its foundation. Two illustrative examples are used to ground the model, a factory with 1,000 IoT-connected robots and an AI-driven anomaly detection process, demonstrating how the model applies in practice before it is extended across all piloting clusters.

For Cluster 1 (Business Integration in Mining), COP-PILOT enables real-time process monitoring and edge-to-cloud continuum orchestration across mining, manufacturing, and recycling environments. Key outcomes include up to a 30% reduction in operational costs through dynamic resource provisioning, early-warning seismic detection mechanisms, and enhanced safety and traceability through blockchain-enabled logistics. Service models are presented for four use cases: IoT Mining Seismics, Logistics of IoT, Condition Monitoring and Predictive Maintenance, and IoT Edge Cloud Continuum for Digital Mines.

For Cluster 2 (Smart Sustainable IoT Solutions in Valencia), COP-PILOT deploys a multi-layer open orchestration framework leveraging IoT, AI extensions, and edge-to-cloud computing across urban, port, campus, and industrial environments. The platform enables data-driven insights for sustainable urban planning, emission reduction, and congestion management, while delivering tangible gains in mobility, port safety, resource efficiency, and smart building management. Service models cover smart city mobility, flood warning systems, connected campus resource and water management, maritime traffic monitoring, and IoT-based environmental quality monitoring.

For Cluster 3A (AgriTech Transformation and Sustainability Initiative), COP-PILOT transforms the agri-food ecosystem through data interoperability, intelligent orchestration, and real-time optimisation. By integrating IoT, agri-robotics, blockchain, and multi-cloud data management, the platform supports precision agriculture, autonomous intervention, secure data sharing, and smart logistics, delivering benefits across farmers, agritech providers, supply chain actors, and consumers alike.

For Cluster 3E (Edge Intelligence for Enhancing Grid Reliability), COP-PILOT strengthens resilience in decentralised electricity networks through edge-based analytics and demand response capabilities. Distribution operators, EV charging networks, and biogas plant operators all benefit from reduced maintenance costs, improved grid reliability, and predictive fault detection, advancing Europe's digital energy transition.

For Cluster 4 (Smart Vineyards and Sustainable Winery Ecosystems), COP-PILOT blends IoT, AI, and machine learning within a GAIA-X aligned, GDPR-compliant sovereign computing continuum. The platform enables predictive irrigation, winery production optimisation, and circular IoT sensor lifecycle management, delivering measurable gains in efficiency, sustainability, and cross-domain data governance.

For more details, refer to **Annex 1.**

4.2 INITIAL PLATFORM DESIGN

This initial COP-PILOT platform architecture is structured across six distinct vertical layers that together form an end-to-end, distributed, and secure service management ecosystem spanning IoT, edge, and cloud environments.

The Infrastructure Layer (INFRA-L) forms the physical foundation, encompassing the highly heterogeneous landscape of IoT devices, edge nodes, private and public cloud domains, and programmable network elements that COP-PILOT must manage. Atop this, the Distributed Infrastructure Services Layer (DIS-L) provides industrial-grade services that abstract the hardware complexity through unified northbound management interfaces, allowing infrastructure owners to mix legacy and advanced technologies as needed.

The Distributed Domain Orchestration Layer (DDO-L) introduces a low-tier domain-level orchestrator (DO) that manages compute, network, and data resources within individual administrative domains, exposing them as services through standardised TMF APIs. A complementary Data Management platform (DM) within DDO-L handles data ingestion, persistence, east-west sharing, and cataloguing, while a Domain Portal provides business-level visibility into domain operations. The layer is modular, allowing domains to deploy only the components relevant to their needs.

The Secure Integration Fabric Layer (SIF-L) addresses the challenge of securely interconnecting the many private domains that constitute the COP-PILOT ecosystem. Rather than relying on traditional VPN configurations, SIF provides programmable VPN-as-a-Service through a software-defined overlay network, enabling dynamic, encrypted tunnels and policy-based access control across all COP-PILOT participants.

The End-to-End Service Orchestration Layer (ESO-L) sits above the individual domain orchestrators and manages multi-domain services spanning the entire COP-PILOT continuum. It breaks down complex service orders into domain-level requests, ensures cross-domain connectivity, supports dynamic runtime updates through policy APIs, and automates the onboarding of new domains into the platform.

The Business Management Layer (BM-L) renders all platform capabilities accessible to diverse stakeholders through an intuitive portal and LLM-powered agents. It supports domain and end-to-end operations including resource ordering, SLA management, platform visualisation, and AI-assisted service composition.

The sectio also maps this architecture to WP3, responsible for the core platform layers (BM-L, ESO-L, DDO-L, SIF-L), and WP4, responsible for the surrounding infrastructure and cluster integrations (INFRA-L, DIS-L, and vertical services). It concludes with a set of nine general platform requirements mandating open standardised APIs, multi-domain orchestration, secure domain interconnection, federated data management, and modern portal visualisation across all platform components.

To further explore this section, refer to **Annex 2**.

4.3 TECHNICAL REQUIREMENT ANALYSIS

This section provides a comprehensive and granular technical requirements analysis for each of the five architectural layers of the COP-PILOT platform, serving as the definitive specification reference for platform development across WP3 and WP4.

The Business Management Layer (BM-L) requirements cover LLM integration, portal functionality, and observability. Key specifications mandate that multiple LLM components — including ETSI OpenSlice, Maestro, and the unified COP-PILOT portal — interface with domain and end-to-end orchestrators via TMF service management APIs. The portal must support role-based access for end users, service developers, and platform operators; federated identity management via OAuth2 and Keycloak; multimodal service descriptor uploads in YAML, JSON, or natural language; LLM-assisted descriptor generation and validation; and full-service lifecycle management from onboarding through decommission. Observability requirements include Prometheus-based telemetry, TMF 628 performance management APIs, and XAI dashboards for AI model monitoring.

The End-to-End Service Orchestration Layer (ESO-L) requirements address cross-domain service composition, SLA enforcement, and policy-based lifecycle management, ensuring that multi-domain services can be designed, ordered, monitored, and dynamically updated across the full COP-PILOT continuum.

The Distributed Domain Orchestration Layer (DDO-L) requirements specify how the platform must manage compute, network, and data resources within individual domains, including integration with NFV orchestrators for 5G RAN and core network functions, SDN controllers for programmable transport, legacy 5G and transport network systems, and standardised APIs for federated cross-domain data sharing and lifecycle governance.

The Secure Integration Fabric Layer (SIF-L) requirements mandate encrypted transmission and secure storage of all data exchanged across distributed systems, role-based and attribute-based access control governing data visibility for all actor types, and bidirectional encrypted channels ensuring tamper-proof communication between services. Many of the SIF-L entries remain placeholders pending further specification from contributing partners, reflecting the evolving nature of this layer's requirements.

Together, these requirements establish a technically rigorous and interoperable foundation for COP-PILOT's development, ensuring that all platform layers meet the security, scalability, and integration standards necessary for real-world deployment across the project's diverse industrial clusters.

To further dive deep into this field refer to **Annex 3**.

5 CONCLUSION

The context for this deliverable is the rise and convergence of several factors applied to IoT and other industrial endpoints. These are edge computing, the use of advanced 5G connectivity, and the accompanying shift towards processing intelligence and automation at the network's edge. This deliverable lays the foundation for the deployment of private edge systems at a large scale. We consider several heterogenous domains and provide a unified architecture integrating dataspaces and access technologies.

In this deliverable we provide blueprints for 20 use cases across five domains of mining, smart cities ports, logistics and transport, agriculture, energy and viniculture. Each domain has a cluster of use cases which provide an ecosystem to understand, design, prototype, validate and pilot end to end services. From these blueprints we describe a service value model defining outline requirements for a service for each use case.

Each of the ecosystems in the project clusters supports the gradual move towards advanced private infrastructure deployments. We provide here the origins of a platform to turn new applications into various vertical industry sectors and contribute to overall market digitization in Europe.

This deliverable provides a base to develop and promote the overall platform environment that makes real use of advanced types of collaborative services across segments, inspiring new growth capabilities for the overall value chain. We include there the requirements for the creation of an open platform capable of managing various industry sectors across different domains of the compute continuum while offering enhanced security, automation, and intelligence features. The use cases requirements drive the creation of the COP-PILOT platform as an overlay platform framework with any underlay technology spanning from IoT platforms to access segment technologies, to core infrastructure transport segments, and the compute environment.

This deliverable prepares for the next step of: (1) defining more details on the configuration actions needed to support each service, (2) elaboration of the service library and service delivery infrastructure; and (3) definition of the final COP-PILOT architecture which delivers the services across the infrastructure.