D2.1: ECOSYSTEM DEFINITION AND REQUIREMERTS

ANNEX 3: TECHNICAL REQUIREMENTS ANALYSIS

This section provides a deep dive into COP-PILOT's technical requirements, classified across five categories corresponding to the discrete architectural layers outlined in Annex 2 (1.1)

D2.1: Ecosystem definition and requirements

Work package	WP Number 2
Task	Task Number T2.1, T2.2, T2.3
Due date	14/05/2026
Submission date	12/05/2026
Deliverable lead	RedZinc
Version	1.1
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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.
Keywords	IoT Interoperability. Edge Computing. 5G Connectivity, System Intelligence, Automation, Private Edge Systems, Large Scale. Mining, Ports and Logistics, Energy, Agriculture, Viticulture,

Document Revision History

Version	Date	Description of change	List of contributors(s)
V0.1a	3.7.2025	Table of Contents	Donal Morris, RedZinc
V0.1b	4.7.2025	Table of Contents PMT Review	PMT
V0.1c	10.7.2025	Table of Contents WP2 Review	WP2
V0.2	24.9.2025	Working Draft	WP2
V0.3	15.10.2025	Working Draft	WP2
V0.4	15.10.2025	Working Draft	WP2
V0.5	20.10.2025	Working Draft	WP2
V0.6	15.10.2025	Working Draft	WP2
V0.7	24.10.2025	Review Document	WP2
V0.8	25.10.2025	Quality Control Document	WP2
V0.9	25.10.2025	Quality Control Document	RedZinc Team
V1.0	31.10.2025	Final Version for Submission	RedZinc Team NetCompany
V1.0	22.1.2025	Final Version for Submission with info graphics	RedZinc Team NetCompany
V1.0	22.1.2025	Final Version for Submission with info graphics	RedZinc Team NetCompany
V1.0	12/05/2026	Sections made into a separate annexes	RedZinc Team NetCompany

Grant Agreement No: 101189819 | **Topic:** HORIZON-CL4-2024-DATA-01-03
Call: HORIZON-CL4-2024-DATA-01 | **Type of action:** HORIZON-IA

DISCLAIMER

Co-funded by the European Union

Project funded by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Co-funded by the European Union (COP-PILOT, 101189819). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them. This work has received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

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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
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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.

TECHNICAL REQUIREMENTS ANALYSIS

The objective of this section is to provide a deep dive into COP-PILOT's technical requirements, focusing on large modules of the COP-PILOT system. These requirements are classified across 5 different categories, each corresponding to a discrete layer of the initial COP-PILOT architecture presented in Annex 2.

MODULE REQUIREMENTS FOR THE COP-PILOT BM-L

Table 3.1 provides a list of business management requirements that need to be ensured by the COP-PILOT platform at the BM-L.

Table 3.1: Functional business management requirements.

Requirement ID	Requirement Analysis
MSR.BML.LLM1	Description: ETSI OpenSlice LLM MUST interface with the domain orchestrator via TMF service management API blueprints and calls
	Affected Components: BM-L, DDO-L
	Contributing Partners: UOP
	Comment: To be integrated in the OSL portal in 2025
MSR.BML.LLM2	Description: Maestro LLM MUST interface with the End-to-End Service Orchestrator via TMF service management API blueprints and calls
	Affected Components: BM-L, ESO-L
	Contributing Partners: UBI
	Comment: Not available today, but planned in early 2026
MSR.BML.LLM3	Description: The COP-PILOT portal MUST interface with the Domain Orchestrator and End-to-End Service Orchestrator via TMF service management APIs
	Affected Components: BML-L, ESO-L, DDO-L
	Contributing Partners: AGE, UBI, UOP
	Comment: Expectation to incorporate LLM agents into the common COP-PILOT portal
MSR.BML.LLM4	Description: LLM-Based User Interaction / LLM-assisted Service Composition MUST interface with the Domain Orchestrator & End-to-End Service Orchestrator via TMF service management APIs
	Affected Components: BML-L, ESO-L, DDO-L
	Contributing Partners: ONE, UBI, UOP
	Comment: Not available today / planned early 2026 Based on COP-PILOT needs and other partners efforts
MSR.BML.LLM5	Description: LLM & agents I/O guardrails MUST interface with the E2E Service Orchestrator, other Business Portal Components with which LLM interacts (e.g. Party Management, Observability) via Python or HTTP REST APIs exposable
	Affected Components: BM-L, ESO-L
	Contributing Partners: IPN, UBI
	Comment: Not available today, planned in end 2025 / early 2026
MSR.BML.LLM6	Description: LLM-Based Intent Recognition Engine MUST interface with the Domain orchestrator via HTTP REST APIs for orchestration

	Affected Components: BM-L, DDO-L
	Contributing Partners: KON, UOP
	Comment: N/A
MSR.BML.PM1	Description: ETSI OpenSlice Party Management Portal and APIs MUST interface with the Domain Orchestrator via TMF Party Management APIs
	Affected Components: OSL PM, DDO-L
	Contributing Partners: UOP
	Comment: N/A
MSR.BML.PM2	Description: Maestro Party Management Portal and APIs MUST interface with the End-to-End Service Orchestrator via TMF Party Management APIs
	Affected Components: Maestro PM, ESO-L
	Contributing Partners: UBI
	Comment: N/A
MSR.BML.PM3	Description: The COP-PILOT portal MUST interface with Domain Orchestrator and End-to-End Service Orchestrator
	Affected Components: Portal, ESO-L, DDO-L
	Contributing Partners: AGE, UBI, UOP
	Comment: Expectation to unify both portals above under a common one for COP-PILOT
MSR.BML.DE1	Description: Maestro Domain Expansion Portal MUST interface with the End-to-End Service Orchestrator via TMF Party Management APIs/TMF Location Management APIs
	Affected Components: Maestro, ESO-L
	Contributing Partners: UBI
	Comment: Uses the TMF Party Management API to peer with adjacent orchestrators in other domains. TMF Location Management APIs are used to denote the location of these orchestrators/domains. View not available today, but planned by the end of 2025
MSR.BML.DE2	Description: The COP-PILOT portal MUST interface with the End-to-End Service Orchestrator via TMF Party Management APIs/TMF Location Management APIs
	Affected Components: Portal, ESO-L
	Contributing Partners: AGE, UBI
	Comment: Expectation to incorporate this view into the common COP-PILOT portal
MSR.BML.DE3	Description: Domain Expansion APIs MUST interface with the End-to-End Service Orchestrator via TMF Location Management APIs
	Affected Components: BM-L, ESO-L
	Contributing Partners: ONE, UBI
	Comment: We are also interested in understanding how to integrate new domains and adjacent orchestrators
MSR.BML.OUI1	Description: Maestro Telemetry MUST interface with the End-to-End Service Orchestrator via Prometheus
	Affected Components: Maestro, ESO-L
	Contributing Partners: UBI
	Comment: Service-level metrics Based on Prometheus

MSR.BML.OUI2	Description: ETSI OpenSlice Telemetry (Metrico) MUST interface with the Domain Orchestrator via Prometheus + TMF 628 Performance Management API
	Affected Components: OSL, DDO-L
	Contributing Partners: UOP
	Comment: Based on Prometheus Prometheus metrics to TMF 628 metrics
MSR.BML.OUI3	Description: The COP-PILOT portal MUST interface with Domain Orchestrator and End-to-End Service Orchestrator via Prometheus + TMF 628 Performance Management API
	Affected Components: Portal, ESO-L, DDO-L
	Contributing Partners: AGE, UBI, UOP
	Comment: Expectation to incorporate these views into the common COP-PILOT portal
MSR.BML.OUI4	Description: NetFoundry BrowZer MUST interface with the Domain Orchestrator via Rest API
	Affected Components: SIF-L, DDO-L
	Contributing Partners: TATA, UOP
	Comment: Clientless endpoint for 'dark UI' (applies to the entire business portal)
MSR.BML.OUI5	Description: Models Observability + XAI Dashboard MUST interface with LLM, Other AI Engines via Rest API
	Affected Components: BM-L, DDO-L
	Contributing Partners: SUITE5, UBI, UOP
	Comment: Based on AI-DAPT and XMANAI project where we monitor models performance and build XAI dashboards
MSR.BML.BP1	Description: The portal must support role-based access for: - End-users/customers: browse, request, monitor services. - Service developers: onboard, describe, and test services. - Service providers/operators: manage deployments, monitor resources.
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP2	Description: Authentication/authorization must support federated identity (OAuth2, Keycloak)
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP3	Description: The portal must enable uploading or describing services in different formats: - Structured descriptors (YAML/JSON). - Multimodal inputs (text prompt, image, code snippet).
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP4	Description: Integration with LLM-based service descriptor generator to transform natural input into orchestration blueprints.
	Affected Components: Portal

	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP5	Description: Validation of submitted descriptors (schema checks, compliance with COP-PILOT orchestration standards).
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP6	Description: Lifecycle management features: Onboarding -> Testing -> Deployment -> Update -> Decommission.
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP7	Description: Provide intuitive web-based front-end, responsive (desktop, tablet, mobile).
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP8	Description: Dashboard views tailored by role: - Customers -> available services, usage status, billing. - Developers -> service onboarding, logs, validation results. - Providers -> system monitoring, orchestration overview.
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP9	Description: Guided onboarding wizard (step-by-step) with both manual and AI-assisted (LLM) modes.
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP10	Description: Portal must communicate with COP-PILOT orchestrator APIs
	Affected Components: Portal
	Contributing Partners: AGE, UBI, INTRA
	Comment: N/A
MSR.BML.BP11	Description: Service onboarding outputs must be directly consumable by orchestrators (ETSI OSM, Kubernetes, FIWARE).
	Affected Components: Portal
	Contributing Partners: AGE, UBI, INTRA
	Comment: N/A
MSR.BML.BP12	Description: Ensure logging, monitoring, and status feedback loops from orchestrator to portal dashboard.
	Affected Components: Portal
	Contributing Partners: AGE, UBI, INTRA
	Comment: N/A
MSR.BML.BP13	Description: Accept multimodal input (text, images, artefacts).
	Affected Components: Portal
	Contributing Partners: AGE

	Comment: N/A
MSR.BML.BP14	Description: Translate user input into service descriptors (blueprints) using LLM.
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP15	Description: Provide explainability: show users how their input was translated (e.g., preview of generated YAML before deployment).
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP16	Description: Allow human override/editing of AI-generated descriptors.
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP17	Description: Ensure data privacy (no leakage of proprietary service info to external AI without safeguards).
	Affected Components: Portal
	Contributing Partners: AGE
	Comment: N/A
MSR.BML.BP18	Description: consume Domain Service Mgmt APIs (Catalogs, Order, Inventory) and offer the respective GUI
	Affected Components: Portal
	Contributing Partners: UoP
	Comment: DDO-side portal
MSR.BML.BP19	Description: consume Domain Resource Mgmt APIs (Catalogs, Order, Inventory) and offer the respective GUI
	Affected Components: Portal
	Contributing Partners: UoP
	Comment: DDO-side portal
MSR.BML.BP20	Description: consume Party Mgmt APIs and offer the respective GUI
	Affected Components: Portal
	Contributing Partners: UoP
	Comment: DDO-side portal
MSR.BML.BP21	Description: offer the respective GUI to design domain-relevant services, also incorporating telemetry sources if needed
	Affected Components: Portal
	Contributing Partners: UoP
	Comment: DDO-side portal
MSR.BML.BP22	Description: provide the respective GUI to design data management-related domain services and offer them as-a-Service (aaS)
	Affected Components: Portal
	Contributing Partners: UoP, FIWARE
	Comment: DDO-side portal
MSR.BML.BP23	Description: offer a "shopping card" GUI that enables users to order exposed domain services for deployment

	Affected Components: Portal
	Contributing Partners: UoP
	Comment: DDO-side portal

MODULE REQUIREMENTS FOR THE COP-PILOT ESO-L

Table 3.2 provides a list of end-to-end multi-domain service & resource orchestration requirements that need to be ensured by the COP-PILOT platform at the ESO-L.

Table 3.2: Functional end-to-end service & resource orchestration requirements.

Requirement ID	Requirement Analysis
FNR.ESOL.01	Description: The COP-PILOT ESO **MUST** offer service catalogs for storing relevant service specifications
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: N/A
FNR.ESOL.02	Description: Each service catalog offered by ESO **MUST** contain one or more service categories. End-user services catalog should contain at least 4 service categories, one per vertical sector: (i) Smart Industries, (ii) Smart Buildings, (iii) Smart Farming, (iv) Smart Energy Management Platform services catalog should contain at least three categories of services: (i) Compute services, (ii) Network Services, and (iii) Data Services
	Affected Components: ESO, DO
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners
	Comment: DO is related because platform services are advertised by the DO's catalog and ESO incorporates them in its catalog.
FNR.ESOL.03	Description: Each service category offered by ESO **MUST** contain one or more service specifications. • Smart Industries category should contain as many services as those related to Clusters 1 and 4. • Smart Buildings category should contain as many services as those related to Cluster 2. • Smart Farming category should contain as many services as those related to Cluster 3A • Smart Energy Management category should contain as many services as those related to Cluster 3E

	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners, Clusters
	Comment: N/A
FNR.ESOL.04	Description: The COP-PILOT ESO **MUST** allow users to Create/Read/Update/Delete (CRUD) service catalogs via API calls and the BM Portal.
	Affected Components: BMP, ESO
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: N/A
FNR.ESOL.05	Description: The COP-PILOT ESO **MUST** allow users to Create/Read/Update/Delete (CRUD) service categories via API calls and the BM Portal.
	Affected Components: BMP, ESO
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: N/A
FNR.ESOL.06	Description: The COP-PILOT ESO **MUST** allow users to Create/Read/Update/Delete (CRUD) service specifications via API calls and the BM Portal.
	Affected Components: BMP, ESO
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: N/A
FNR.ESOL.07	Description: The COP-PILOT ESO **MUST** offer service catalogs, categories, and specifications via a standardized API.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: N/A
FNR.ESOL.08	Description: The COP-PILOT ESO **MUST** allow users to add a service specification into a "shopping cart" to facilitate service ordering.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: N/A
FNR.ESOL.09	Description: When a service specification is added into a shopping cart, COP-PILOT ESO **MUST** suggest default values (via API call and BM Portal) per service spec. characteristics, to guide the user on how to fill in a service order
	Affected Components: BMP, ESO

	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: N/A
FNR.ESOL.10	Description: The COP-PILOT ESO **MUST** allow users to place an order for an end-user service atop a new compute cluster.
	Affected Components: BMP, ESO, Compute Controller
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: N/A
FNR.ESOL.11	Description: The COP-PILOT ESO **MUST** allow users to place an order for an end-user service atop an existing compute cluster (already deployed by a previous service order).
	Affected Components: BMP, ESO, Compute Controller
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: N/A
FNR.ESOL.12	Description: The COP-PILOT ESO **MUST** allow users to place orders for platform services.
	Affected Components: BMP, ESO
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: N/A
FNR.ESOL.13	Description: The COP-PILOT ESO **MUST** allow users to place orders with more than one service specifications.
	Affected Components: BMP, ESO
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: To support composite vertical services.
FNR.ESOL.14	Description: The COP-PILOT ESO **MUST** allow service orders for single-domain and multi-domain services via a standardized API.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: N/A
FNR.ESOL.15	Description: The COP-PILOT ESO **MUST** offer service inventory via a standardized API.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: N/A

FNR.ESOL.16	Description: The COP-PILOT ESO **MUST** advertise customer-facing vertical service characteristics of the deployed services.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To allow service providers to modify application-level characteristics in real-time.
FNR.ESOL.17	Description: The COP-PILOT ESO **MUST** advertise runtime compute service characteristics for end user services.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To allow service providers to scale compute resources for a service on demand.
FNR.ESOL.18	Description: The COP-PILOT ESO **COULD** advertise runtime network service characteristics for end user services that consume an underlying network service.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: For services that operate on configurable network slices
FNR.ESOL.19	Description: The COP-PILOT ESO **MUST** allow users to modify the configurable service characteristics of an active service in real-time.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: N/A
FNR.ESOL.20	Description: The COP-PILOT ESO **MUST** integrate with public service registries without authentication
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners, COP-PILOT service providers
	Comment: To pull public service artefacts for deployment
FNR.ESOL.21	Description: The COP-PILOT ESO **MUST** integrate with any private service registry, given that the user has inserted the relevant secrets (username and password) into ESO's encrypted service registry.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners, COP-PILOT service providers
	Comment: To pull private service artefacts - after secure authentication to the registry - for deployment

FNR.ESOL.22	Description: The COP-PILOT ESO **MUST** support both HTTP-based and OCI-based service registries
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners, COP-PILOT service providers
	Comment: N/A
FNR.ESOL.23	Description: The COP-PILOT ESO **MUST** offer a secure and trusted storage service for user secrets required to access private service registries/repositories.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To ensure privacy for service providers
FNR.ESOL.24	Description: The COP-PILOT ESO **MUST** encode individual parties into its Party Management schema.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To model the COP-PILOT ecosystem of individual stakeholders as entities of the platform.
FNR.ESOL.25	Description: The COP-PILOT ESO **MUST** encode organization parties into its Party Management schema.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To model the COP-PILOT ecosystem of organizations as entities of the platform.
FNR.ESOL.26	Description: The COP-PILOT ESO Party Management schema **MUST** allow relationships between (individual and/or organizations) parties
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: N/A
FNR.ESOL.27	Description: The COP-PILOT ESO **MUST** provide a northbound API for managing Parties.
	Affected Components: ESO, BMP
	Contributing Partners: UBI and T3.1 partners
	Comment: To allow managing the parties via API calls or a Portal
FNR.ESOL.28	Description: The COP-PILOT ESO **MUST** ensure that the Party management API relies on open standards

	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To ensure a standardized way of managing parties.
FNR.ESOL.29	Description: The COP-PILOT ESO **MUST** be able to federate remote telemetry services from multiple domains
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To support multi-domain telemetry.
FNR.ESOL.30	Description: The COP-PILOT ESO **MUST** perform telemetry federation in a secure and trusted manner.
	Affected Components: ESO, SIF
	Contributing Partners: UBI and T3.1 partners, TATA and T3.5 partners
	Comment: To fortify multi-domain telemetry with security and trust
FNR.ESOL.31	Description: The COP-PILOT ESO **MUST** expose a northbound telemetry API for multi-domain services.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To offer Telemetry-as-a-Service.
FNR.ESOL.32	Description: The COP-PILOT ESO **MUST** offer telemetry dashboards on top of multi-domain service telemetry data.
	Affected Components: ESO and BMP
	Contributing Partners: UBI and T3.1 partners, AGE and T3.4 partners
	Comment: To visualize multi-service performance.
FNR.ESOL.33	Description: The COP-PILOT ESO **MUST** allow users to customize telemetry data according to their SLAs
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To enable SLA monitoring.
FNR.ESOL.34	Description: The COP-PILOT ESO **MUST** be able to manage (add, remove, list) one or more SIF instances via an API.
	Affected Components: ESO, SIF
	Contributing Partners: UBI and T3.1 partners, TATA and T3.5 partners
	Comment: To enable the expansion of the platform to new territories.

FNR.ESOL.35	Description: The COP-PILOT ESO **MUST** exploit the management API of a SIF instance for managing SIF entities.
	Affected Components: ESO, SIF
	Contributing Partners: UBI and T3.1 partners, TATA and T3.5 partners
	Comment: To manage every SIF instance in a programmatic way.
FNR.ESOL.36	Description: The COP-PILOT ESO **MUST** expose the management API of the SIF instances towards the business portal.
	Affected Components: ESO, SIF, BMP
	Contributing Partners: UBI and T3.1 partners, TATA and T3.5 partners, AGE and T3.4 partners
	Comment: To manage the COP-PILOT networks in a user-friendly manner.
FNR.ESOL.37	Description: The COP-PILOT ESO **COULD** possess a mechanism that verifies the availability of already peered SIF instances, otherwise remove them from the platform
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To ensure consistent state management of the underlying SIF platforms.
FNR.ESOL.38	Description: The COP-PILOT ESO **MUST** be able to manage (add, remove, list) one or more private domains, while managing their authentication (identities) against SIF.
	Affected Components: ESO, SIF
	Contributing Partners: UBI and T3.1 partners, TATA and T3.5 partners
	Comment: N/A
FNR.ESOL.39	Description: The COP-PILOT ESO **MUST** expose the management API of the private domains towards the business portal.
	Affected Components: ESO, SIF
	Contributing Partners: UBI and T3.1 partners, TATA and T3.5 partners
	Comment: N/A
FNR.ESOL.40	Description: The COP-PILOT ESO **COULD** possess a mechanism that verifies the availability of already connected private domains, otherwise remove them from the platform
	Affected Components: ESO, SIF
	Contributing Partners: UBI and T3.1 partners, TATA and T3.5 partners
	Comment: To ensure consistent state management of the underlying SIF domains.

FNR.ESOL.41	Description: The COP-PILOT ESO **MUST** be able to manage (add, remove, list) a Domain Orchestrator instance.
	Affected Components: ESO, DO
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners
	Comment: N/A
FNR.ESOL.42	Description: The COP-PILOT ESO **MUST** expose the management API of the Domain Orchestrators towards the business portal.
	Affected Components: ESO, DO
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners
	Comment: N/A
FNR.ESOL.43	Description: The COP-PILOT ESO **COULD** possess a mechanism that verifies the availability of already connected Domain Orchestrators, otherwise remove them from the platform.
	Affected Components: ESO, DO
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners
	Comment: To ensure consistent state management of the underlying Domain Orchestrators.
FNR.ESOL.44	Description: The COP-PILOT ESO **MUST** be able to manage (add, remove, list) a compute cluster via the respective DO API.
	Affected Components: ESO, DO, Compute cluster
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners, Compute cluster providers across all Clusters
	Comment: N/A
FNR.ESOL.45	Description: The COP-PILOT ESO **MUST** expose the management API of the compute clusters towards the business portal.
	Affected Components: ESO, DO, Compute cluster
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners, Compute cluster providers across all Clusters
	Comment: N/A
FNR.ESOL.46	Description: The COP-PILOT ESO **COULD** possess a mechanism that verifies the availability of already active compute clusters, otherwise remove them from the platform.
	Affected Components: ESO, DO, Compute cluster
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners, Compute cluster providers across all Clusters
	Comment: To ensure consistent state management of the underlying clusters.

FNR.ESOL.47	Description: The COP-PILOT ESO **MUST** expose a northbound API for service providers to manage (create, read, delete) SLAs for their services.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To ensure SLA management of multi-domain services.
FNR.ESOL.48	Description: The COP-PILOT ESO **MUST** ensure that the SLA management API relies on open standards.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To ensure adoption of this API by the industry.
FNR.ESOL.49	Description: The COP-PILOT ESO **MUST** be able to parse an SLA request for a multi-domain service and break it down to sub-SLA requests towards different Domain Orchestrators.
	Affected Components: ESO
	Contributing Partners: UBI and T3.1 partners
	Comment: To ensure multi-domain SLAs are managed in every domain.
FNR.ESOL.50	Description: The COP-PILOT ESO **COULD** exploit the same SLA Management API with the DO to facilitate SLA management.
	Affected Components: ESO, DO
	Contributing Partners: UBI and T3.1 partners, UOP and T3.2 partners
	Comment: To promote a unified way of managing SLAs.

MODULE REQUIREMENTS FOR THE COP-PILOT DDO-L

Table 3.3 provides a list of domain-level service and resource orchestration requirements that need to be ensured by the COP-PILOT platform at the DDO-L.

Table 3.3: Functional domain-level service & resource orchestration requirements.

Requirement ID	Requirement Analysis
FNR.DDOL.DO.01	Description: The COP-PILOT DO **MUST** offer service catalogs for storing domain-relevant service specifications
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.02	Description: Each service catalog offered by DO **COULD** contain 1 or more service categories
	Affected Components: DO
	Contributing Partners: T4.1 partners
	Comment: N/A
FNR.DDOL.DO.03	Description: Each service category offered by DO **COULD** contain 1 or more service specifications
	Affected Components: DO, ESO
	Contributing Partners: T4.1 partners
	Comment: ESO needs to be aware of the created service specifications' identifiers
FNR.DDOL.DO.04	Description: The COP-PILOT DO **MUST** allow the definition (type, default value, etc.) of service specification characteristics that distinguish the specification
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.05	Description: The COP-PILOT DO **MUST** offer service catalogs, categories, specification management via standardized APIs
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: Compliance with TMF633 Service Catalog Management
FNR.DDOL.DO.06	Description: The COP-PILOT DO **MUST** allow the issuing of a service order based on exposed service specifications
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: ESO will issue service order requests to DO
FNR.DDOL.DO.07	Description: The COP-PILOT DO **MUST** allow the combination of two or more service specifications under the same service order
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.08	Description: The COP-PILOT DO **MUST** allow the preview of issued service orders and the monitoring of their progress
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.09	Description: The COP-PILOT DO **MUST** allow the editing of the requested duration of issued service orders, as well as other order characteristics
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.10	Description: The COP-PILOT DO **MUST** allow the termination of issued service orders upon request
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.11	Description: The COP-PILOT DO **COULD** allow simple user roles to issue and preview service orders, while introducing a privileged user role that can also acknowledge the issued orders for fulfilment
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.12	Description: The COP-PILOT DO **MUST** allow all the mentioned actions via a standardized API
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: Compliance with TMF641 Service Order Management
FNR.DDOL.DO.13	Description: The COP-PILOT DO **MUST** allow the preview of deployed services and their runtime characteristics, created by fulfilled service orders
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.14	Description: The COP-PILOT DO **MUST** be able to bind the deployed services with the respective service order
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.15	Description: The COP-PILOT DO **MUST** allow the editing of the requested duration of deployed services, as well as other configurable service characteristics
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.16	Description: The COP-PILOT DO **MUST** allow the termination of deployed services upon request
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.17	Description: The COP-PILOT DO **MUST** be able to differentiate between customer-facing and resource-facing services (that create resources)
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.18	Description: The COP-PILOT DO **MUST** display the association of a service with related services and/or resources
	Affected Components: DO, ESO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.19	Description: The COP-PILOT DO **MUST** offer detailed notes presenting the lifecycle stages of the deployed service
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.20	Description: The COP-PILOT DO **MUST** allow the addition of user-related notes to the deployed service
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.21	Description: The COP-PILOT DO **MUST** allow all the mentioned actions via a standardized API
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: Compliance with TMF638 Service Inventory Management
FNR.DDOL.DO.22	Description: The COP-PILOT DO **MUST** allow the addition of user-related notes to the deployed service
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.23	Description: The COP-PILOT DO **MUST** capture acknowledged service orders and initiate their fulfilment
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.24	Description: The COP-PILOT DO **MUST** be able to handle several parallel service orders
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.25	Description: The COP-PILOT DO **MUST** decompose the service bundle that is requested through a service order and create the respective services
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.26	Description: The COP-PILOT DO **MUST** create services in parallel, but also respect service creation dependencies when requested
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.27	Description: The COP-PILOT DO **MUST** inject custom logic in several lifecycle phases of the created services
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.28	Description: The COP-PILOT DO **MUST** decide which controller to employ to execute the logic behind the created services
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.29	Description: The COP-PILOT DO **MUST** control the full lifecycle of a service, e.g. creation, operation, supervision, termination, and/or failure
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.30	Description: The COP-PILOT DO **COULD** request service deployments towards external orchestrators
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.31	Description: The COP-PILOT DO **MUST** create the respective resources, stemming from the creation of resource-facing services
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.32	Description: The COP-PILOT DO **MUST** control the full lifecycle of a resource, e.g., creation, operation, supervision, termination, and/or failure
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.33	Description: The COP-PILOT DO **MUST** store resource specifications, which represent domain-relevant resource controllers
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.34	Description: The COP-PILOT DO **MUST** enable the utilization of offered resource specifications in service specification(s) design
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.35	Description: Each resource specification offered by DO **MUST** allow the definition (type, default value, etc.) of resource specification characteristics that distinguish the specification
	Affected Components: DO
	Contributing Partners: T4.1 partners
	Comment: N/A
FNR.DDOL.DO.36	Description: The COP-PILOT DO **MUST** offer resource specification management via standardized APIs
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: Compliance with TMF634 Resource Catalog Management
FNR.DDOL.DO.37	Description: The COP-PILOT DO **MUST** ensure that the resource order entirely matches the respective service order's lifecycle
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.38	Description: The COP-PILOT DO **MUST** ensure that the resource order is only triggered by the respective service order (of a resource-facing service specification) and it is an internal task of the Core Domain Orchestrator
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.39	Description: The COP-PILOT DO **MUST** ensure the creation of the respective resource, stemming from the related resource specification
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.40	Description: The COP-PILOT DO **MUST** allow the preview of created resources and their runtime characteristics, created by fulfilled resource orders
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.41	Description: The COP-PILOT DO **MUST** allow the preview of resource characteristics
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.42	Description: The COP-PILOT DO **MUST** allow the preview of the stemming resource specification, which the resource is based upon
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.43	Description: The COP-PILOT DO **MUST** offer detailed notes presenting the lifecycle stages of the resource
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners

	Comment: N/A
FNR.DDOL.DO.44	Description: The COP-PILOT DO **MUST** display the association of a resource with related resources
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.45	Description: The COP-PILOT DO **MUST** allow all the mentioned actions via a standardized API
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: Compliance with TMF639 Resource Inventory Management
FNR.DDOL.DO.46	Description: The COP-PILOT DO **MUST** be able to integrate domain-owned monitoring systems (Prometheus instances)
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.47	Description: The COP-PILOT DO **MUST** allow the service designer to define the desired metrics retrieval URL, the retrieval interval, the retrieval duration, and the associated service from the Domain Service Inventory
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.48	Description: The COP-PILOT DO **MUST** retrieve and present metrics inherently through the Domain Service Inventory
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.49	Description: The COP-PILOT DO **MUST** update the service lifecycle with external monitoring data through lifecycle management rules
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners

	Comment: N/A
FNR.DDOL.DO.50	Description: The COP-PILOT DO **MUST** enhance the domain closed-loop management by integrating monitoring data
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.51	Description: The COP-PILOT DO **MUST** design the mentioned actions via a standardized API and data models
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: Compliance with TMF638 Service Inventory Management and TMF628 Performance Management
FNR.DDOL.DO.52	Description: The COP-PILOT DO **MUST** encode individual parties
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.53	Description: The COP-PILOT DO **MUST** encode organization parties
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.54	Description: The COP-PILOT DO **MUST** allocate each service specification to its related party
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.55	Description: The COP-PILOT DO **MUST** allocate each service to its related party
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A

FNR.DDOL.DO.56	Description: The COP-PILOT DO **COULD** allow service categories and specifications exchange with registered organizations
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.57	Description: The COP-PILOT DO **COULD** allow service orchestration delegation to partnered organizations
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.58	Description: The COP-PILOT DO **COULD** allow partnered service preview, when created by a partnered orchestration delegation
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: N/A
FNR.DDOL.DO.59	Description: The COP-PILOT DO **MUST** allow party management via standardized APIs
	Affected Components: DO
	Contributing Partners: UOP and T3.2 partners
	Comment: Compliance with TMF632 Party Management
FNR-DDOL.DO.60	Description. COP-PILOT **MUST** be compliant with ColonyOS resource definition specification (based on OpenAPI specification) for deployment orchestration.
	Affected Component: DO
	Contributing Partner: UoP, Ubitech
	Comment: ColonyOS will deploy and configure Arrowhead

Table 3.4 provides a list of domain-level data management requirements that need to be ensured by the COP-PILOT platform at the DDO-L.

Table 3.4: Functional domain-level data management requirements.

Requirement ID	Requirement Analysis
FNR.DDOL.DM.01	Description: The COP-PILOT Data Mgmt. **MUST** provide declarative management of data resources across edge and cloud domains, leveraging the ColonyOS resource specification, reconciliation mechanism, and meta-filesystem to control data placement, movement, and accessibility without enabling direct external control of mining infrastructure.
	Affected Components: DomainOrch (OpenSlice), ColonyOS (including ColonyFS meta-filesystem)
	Contributing Partners: LTU, RISE, UoP
	Comment: Ensures governance-compliant data handling, including visibility, replication, and synchronization to support cloud bursting and cross-domain workflows while maintaining full control within the mining operator.
FNR.DDOL.DM.02	Description: The system **MUST** support secure integration and orchestration of IoT devices and industrial controllers using Arrowhead Framework services, enabling local automation within mining environments while maintaining strict isolation from external control.
	Affected Components: Arrowhead
	Contributing Partners: LTU, RISE
	Comment: Provides service discovery, access control, and secure communication primitives for IoT/OT, ensuring interoperability across heterogeneous mining equipment without compromising operational sovereignty.
FNR.DDOL.DM.03	Description: The COP-PILOT Data Mgmt. **MUST** be able to support aggregation and historical analytics storage.
	Contributing Partners: LTU, RISE
	Comment: N/A
FNR.DDOL.DM.04	Description: The COP-PILOT Data Mgmt. **MUST** guarantee high reliability and delivery confirmation
	Contributing Partners: LTU, RISE
	Comment: N/A
FNR.DDOL.DM.05	Description: The COP-PILOT Data Mgmt. **MUST** provide real-timeevent and alert management
	Contributing Partners: LTU, RISE
	Comment: N/A

FNR.DDOL.DM.06	Description: The COP-PILOT Data Mgmt. **MUST** guarantee time-series data integrity and traceability
	Contributing Partners: LTU, RISE
	Comment: N/A
FNR.DDOL.DM.07	Description: The COP-PILOT Data Mgmt. **MUST** support ingestion of the latest telemetry via MQTT, LoRaWAN, NB-IoT, etc.
	Contributing Partners: LTU, RISE
	Comment: N/A
FNR.DDOL.DM.08	Description: The COP-PILOT Data Mgmt. **MUST** expose a standardized Northbound API (NGSI-LD) for apps to make queries.
	Contributing Partners: LTU, RISE
	Comment: N/A
FNR.DDOL.DM.09	Description: The COP-PILOT Data Mgmt. **MUST** enable Federated and Hierarchical broker architectures for data synchronization.
	Contributing Partners: LTU, RISE
	Comment:
FNR.DDOL.DM.10	Description: The COP-PILOT Data Mgmt. **MUST** support real-time updates to internal apps via a Subscription (Pub/Sub) mechanism.
	Contributing Partners: LTU, RISE
	Comment: N/A
FNR.DDOL.DM.11	Description: The COP-PILOT Data Mgmt. **MUST** allow for granular filtering of context information shared between distributed brokers
	Contributing Partners: LTU, RISE
	Comment: N/A
FNR.DDOL.DM.12	Description: The COP-PILOT Data Management layer **MUST** support persistent storage and historical tracking of IoT device lifecycle states (e.g., deployment, activation, maintenance, reuse, decommissioning) using FIWARE-compliant data models.
	Affected Components: Distributed Domain Orchestration Layer (Data management)
	Contributing Partners: LTU, HOSCH, TAB, PAB, ROC, TID, AUA, TOR, BAR, AGA, ILINK,RZ, ONE
	Comment: Required to enable traceability of sensor reuse, lifecycle analytics, and sustainability KPIs.

FNR.DDOL.DM.13	Description: The COP-PILOT Data Management layer **MUST** support ingestion, aggregation, and historical storage of environmental, soil, irrigation, and weather-related data streams in near real-time
	Affected Components: Distributed Domain Orchestration Layer (Data management)
	Contributing Partners: LTU, HOSCH, TAB, PAB, ROC, TID, AUA, TOR, BAR, AGA, ILINK,RZ, ONE, TER
	Comment: Enables irrigation analytics, water optimization KPIs, and long-term soil performance analysis
FNR.DDOL.DM.14	Description: The COP-PILOT Data Management layer **MUST** support correlation and contextualization of multi-source data (e.g., satellite inputs, weather forecasts, field sensors) through harmonized FIWARE data models
	Affected Components: Distributed Domain Orchestration Layer (Data management)
	Contributing Partners: LTU, HOSCH, TAB, PAB, ROC, TID, AUA, TOR, BAR, AGA, ILINK,RZ, ONE, TER
	Comment: Required for hybrid irrigation strategies and predictive decision support.
FNR.DDOL.DM.15	Description: The COP-PILOT Data Management layer **MUST** support structured ingestion and historical storage of production-line data (e.g., machine states, OEE parameters, downtime events) via standardized APIs.
	Affected Components: Distributed Domain Orchestration Layer (Data management)
	Contributing Partners: LTU, HOSCH, TAB, PAB, ROC, TID, AUA, TOR, BAR, AGA, ILINK,RZ, ONE, JIG
	Comment: Necessary for OEE computation and operational analytics
FNR.DDOL.DM.16	Description: The COP-PILOT Data Management layer **MUST** support real-time ingestion, contextualization, and historical storage of energy-related metrics from renewable-powered 5G sites, including per-device energy consumption, site-level energy availability, and communication-related power usage.
	Affected Components: Distributed Domain Orchestration Layer (Data management)
	Contributing Partners: LTU, HOSCH, TAB, PAB, ROC, TID, AUA, TOR, BAR, AGA, ILINK,RZ, ONE, NOKIA
	Comment: Required to enable energy accounting per deployed and activated device, ensuring service availability monitoring and energy-efficiency analytics in isolated vineyard environments

FNR.DDOL.DM.17	Description: The COP-PILOT Data Management service of the DDO-L **MUST** support real-time ingestion, contextualization, and lifecycle management of parcel-centric agronomic data, including sensor streams, UAV imagery metadata, robotic intervention logs, and cultivation records.
	Affected Components: COP-PILOT Data Management
	Contributing Partners: AgroApps, AUA, TOR
	Comment: N/A
FNR.DDOL.DM.18	Description: The COP-PILOT Data Management service of the DDO-L **MUST** maintain state-aware data propagation across monitoring, intervention, certification, and logistics phases, ensuring consistent parcel-level data updates across domains.
	Affected Components: COP-PILOT Data Management
	Contributing Partners: AgroApps, ILINK, BAR
	Comment: N/A
FNR.DDOL.DM.19	Description: The COP-PILOT Data Management service of the DDO-L **MUST** ensure edge-to-cloud data consistency, including buffering, reconciliation, and version control of agronomic datasets generated by field devices during intermittent connectivity.
	Affected Components: COP-PILOT Data Management
	Contributing Partners: AgroApps, AUA, TOR, OTE
	Comment: N/A
FNR.DDOL.DM.20	Description: The COP-PILOT Data Mgmt. **MUST** support ingestion of data from heterogeneous sensor sources, including sensors operating under different communication protocols, data formats, and sampling rates.
	Affected Components: COP-PILOT Data Management
	Contributing Partners: ENIK, UoP, PPC, BPO
	Comment: N/A
FNR.DDOL.DM.21	Description: The COP-PILOT Data Mgmt. **MUST** enable data sharing across organisational and technical domain boundaries, ensuring interoperability between disparate systems and stakeholders.
	Affected Components: COP-PILOT Data Management
	Contributing Partners: ENIK, UoP, PPC, BPO
	Comment: N/A
FNR.DDOL.DM.22	Description: The COP-PILOT Data Mgmt. **MUST** provide local data storage capabilities, ensuring data persistence and availability independently of external network connectivity.

	Affected Components: COP-PILOT Data Management
	Contributing Partners: ENIK, UoP, PPC, BPO
	Comment: N/A
FNR.DDOL.DM.23	Description: The COP-PILOT Data Mgmt. **MUST** expose well-defined APIs to facilitate data ingestion into target applications, supporting both push and pull data transfer patterns.
	Affected Components: COP-PILOT Data Management
	Contributing Partners: ENIK, UoP, PPC, BPO
	Comment: N/A

MODULE REQUIREMENTS FOR THE COP-PILOT DIS-L

Table 3.5 provides a list of infrastructure-level requirements that need to be ensured by the COP-PILOT platform at the DIS-L.

Table 3.5: Functional infrastructure management requirements.

Requirement ID	Requirement Analysis
FNR.DISL.01	Description: The COP-PILOT platform **MUST** be able to manage virtual machine-based compute resources exposed by relevant Virtual Infrastructure Management (VIM) controllers.
	Affected Components: DO, Compute Controllers
	Contributing Partners: Cluster infrastructure providers, UOP and T3.2 partners
	Comment: Ensures that the platform shall interface with well-known VIM platforms, such as OpenStack, Proxmox, etc.
FNR.DISL.02	Description: The COP-PILOT platform **MUST** be able to manage containerized compute resources exposed by relevant Container Infrastructure Management (CIM) controllers.
	Affected Components: DO, Compute Controllers
	Contributing Partners: Cluster infrastructure providers, UOP and T3.2 partners
	Comment: Ensures that the platform shall interface with well-known CIM platforms, such as Kubernetes.
FNR.DISL.03	Description: The COP-PILOT platform **MUST** be able to manage 5G Radio Access Network (RAN) Functions via an NFV Orchestrator.
	Affected Components: DO, Mobile Radio Controllers

	Contributing Partners: Cluster infrastructure providers, UOP and T3.2 partners
	Comment: Ensures that the platform shall interface with well-known and standardized NFVOs.
FNR.DISL.04	Description: The COP-PILOT platform **MUST** be able to manage 5G Core Network (CN) Functions via an NFV Orchestrator.
	Affected Components: DO, Mobile Core Controllers
	Contributing Partners: Cluster infrastructure providers, UOP and T3.2 partners
	Comment: Ensures that the platform shall interface with well-known and standardized NFVOs.
FNR.DISL.05	Description: The COP-PILOT platform **MUST** be able to manage legacy 5G network services.
	Affected Components: DO, Legacy Mobile Network systems
	Contributing Partners: Cluster infrastructure providers, UOP and T3.2 partners
	Comment: Ensures interoperability with legacy 5G systems.
FNR.DISL.06	Description: The COP-PILOT platform **MUST** be able to manage programmable transport network services via an SDN controller.
	Affected Components: DO, SDN Controllers
	Contributing Partners: Cluster infrastructure providers, UOP and T3.2 partners
	Comment: Ensures that the platform shall interface with state-of-the-art SDN controllers.
FNR.DISL.07	Description: The COP-PILOT platform **COULD** be able to manage fixed transport services via legacy TN management platforms.
	Affected Components: DO, Legacy TN management systems
	Contributing Partners: Cluster infrastructure providers, UOP and T3.2 partners
	Comment: Ensures interoperability with legacy TN systems.
FNR.DISL.08	Description: The platform **MUST** expose standardized APIs to enable secure and federated cross-domain data sharing across distributed infrastructures
	Affected Components: DO, Data Connectors
	Contributing Partners: FIWARE and T3.3 contributing partners
	Comment: Ensures effective collaboration and interoperability between domains

FNR.DISL.09	Description: The COP-PILOT platform **MUST** expose standardized APIs and metadata models for distributed data lifecycle management, including ingestion, storage, and deletion policies
	Affected Components: DO, Data Connectors
	Contributing Partners: FIWARE and T3.3 contributing partners
	Comment: Enables consistent governance and synchronization of data streams, ensuring quality, integrity
FNR.DISL.10	Description: The COP-PILOT platform **MUST** enable seamless integration of multiple operational domains through a secure communication channel that provides encrypted, policy-based communication between distributed data and compute resources.
	Affected Components: SIF, DO, Data Connectors.
	Contributing Partners: TATA, FIWARE and T3.3, T3.5 contributing partners
	Comment: Ensures trusted interoperability between domains by enforcing data sovereignty, end-to-end encryption, and standardized federation interfaces.

MODULE REQUIREMENTS FOR THE COP-PILOT SIF-L

Table 3.6 provides a list of connectivity and integration requirements that need to be ensured by the COP-PILOT platform at the SIF-L.

Table 3.6: Functional connectivity and integration requirements.

Requirement ID	Requirement Analysis
FNR.SIFL.01	Description: The COP-PILOT Secure Integration Fabric MUST enforce encrypted transmission and secure storage of data exchanged across distributed systems.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: N/A
FNR.SIFL.02	Description: The COP-PILOT Secure Integration Fabric MUST implement role-based and attribute-based access control policies governing data visibility for vertical sector actors.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: N/A
FNR.SIFL.03	Description: The COP-PILOT Secure Integration Fabric MUST be able to establish bidirectional encrypted channels ensuring the tamper-proof exchange of data and information among services

	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment:
FNR.SIFL.04	Description: The COP-PILOT SIF **MUST** assign a unique cryptographic identity to all participating entities (services, workloads, devices, users) to enable identity-based communication across domains.
	Affected Components: COP-PILOT Secure Integration Fabric, DO, ESO
	Contributing Partners: TATA, UBI, UOP, LTU, UPV, AGA, ONE
	Comment: Enables identity-first connectivity independent of IP addressing.
FNR.SIFL.05	Description: The COP-PILOT SIF **MUST** support mutual authentication between communicating entities prior to establishing any communication channel.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: Ensures authenticate-before-connect model.
FNR.SIFL.06	Description: The COP-PILOT SIF **MUST** enforce fine-grained, policy-based access control at the service level, defining which identities can communicate with which services.
	Affected Components: COP-PILOT Secure Integration Fabric, ESO
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: Moves from network-level to service-level segmentation.
FNR.SIFL.07	Description: The COP-PILOT SIF **MUST** support dynamic policy evaluation based on identity attributes, context, and service definitions.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: Enables ABAC and contextual access.
FNR.SIFL.08	Description: The COP-PILOT SIF **MUST** enable service-to-service connectivity without requiring routable network exposure of endpoints.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: “Dark services” / no inbound exposure.
FNR.SIFL.09	Description: The COP-PILOT SIF **MUST** establish connectivity on-demand based on successful authentication and authorization decisions.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters

	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: No persistent open network paths.
FNR.SIFL.10	Description: The COP-PILOT SIF **MUST** abstract underlying network topology, allowing services to communicate without dependency on IP addressing or network configuration.
	Affected Components: COP-PILOT Secure Integration Fabric, DO
	Contributing Partners: TATA, UOP
	Comment: Decouples connectivity from infrastructure.
FNR.SIFL.11	Description: The COP-PILOT SIF **MUST** support secure federation between multiple domains, enabling controlled cross-domain service communication.
	Affected Components: SIF, ESO
	Contributing Partners: TATA, UBI
	Comment: Core to COP-PILOT vision.
FNR.SIFL.12	Description: The COP-PILOT SIF **MUST** allow trust establishment between domains via exchange or validation of identity authorities (e.g., PKI, federated identity systems).
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: Domain-to-domain trust model.
FNR.SIFL.13	Description: The COP-PILOT SIF **MUST** provide audit logs of all communication sessions, including identities, services accessed, timestamps, and policy decisions.
	Affected Components: COP-PILOT Secure Integration Fabric, ESO
	Contributing Partners: TATA, UBI
	Comment: Identity-level audit (not just IP flows).
FNR.SIFL.14	Description: The COP-PILOT SIF **MUST** expose telemetry on connectivity, policy enforcement, and session performance via standardized APIs.
	Affected Components: COP-PILOT Secure Integration Fabric, ESO
	Contributing Partners: TATA, UBI
	Comment: Integrates with telemetry federation already defined.
FNR.SIFL.15	Description: The COP-PILOT SIF **MUST** maintain connectivity resilience across heterogeneous networks, tolerating disruptions in underlying infrastructure.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE

	Comment: Critical for edge / IoT / mining / agriculture use cases.
FNR.SIFL.16	Description: The COP-PILOT SIF **MUST** support distributed operation without a single point of failure in the connectivity control or data plane.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: Aligns with multi-domain robustness.
FNR.SIFL.17	Description: The COP-PILOT SIF **MUST** support operation in constrained or intermittently connected environments, including edge and remote deployments.
	Affected Components: COP-PILOT Secure Integration Fabric, Clusters
	Contributing Partners: TATA, LTU, UPV, AGA, UOP, ONE
	Comment: Important for COP-PILOT verticals.