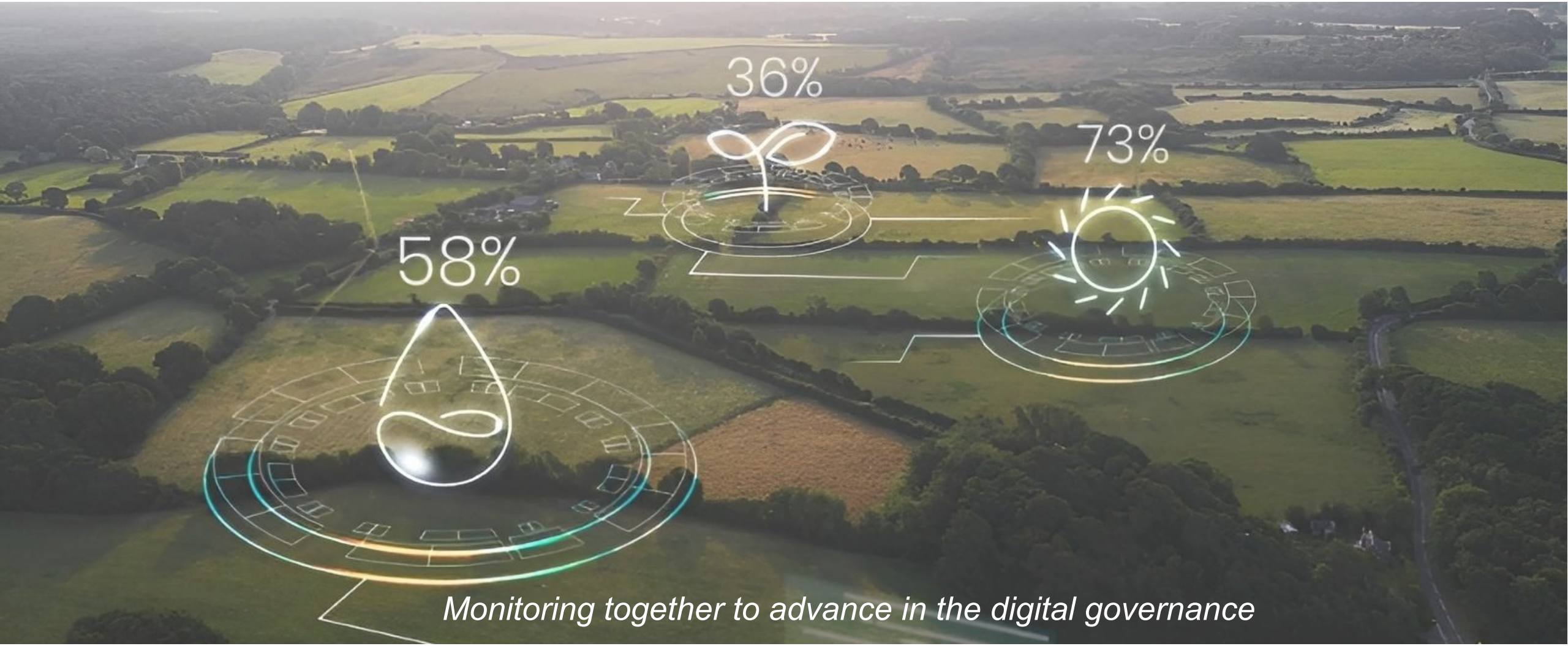
PNRR SIM
M2C4 I. 1.1: REALIZZAZIONE DI UN SISTEMA AVANZATO ED INTEGRATO DI MONITORAGGIO E PREVISIONE



Finanziato dall'Unione europea
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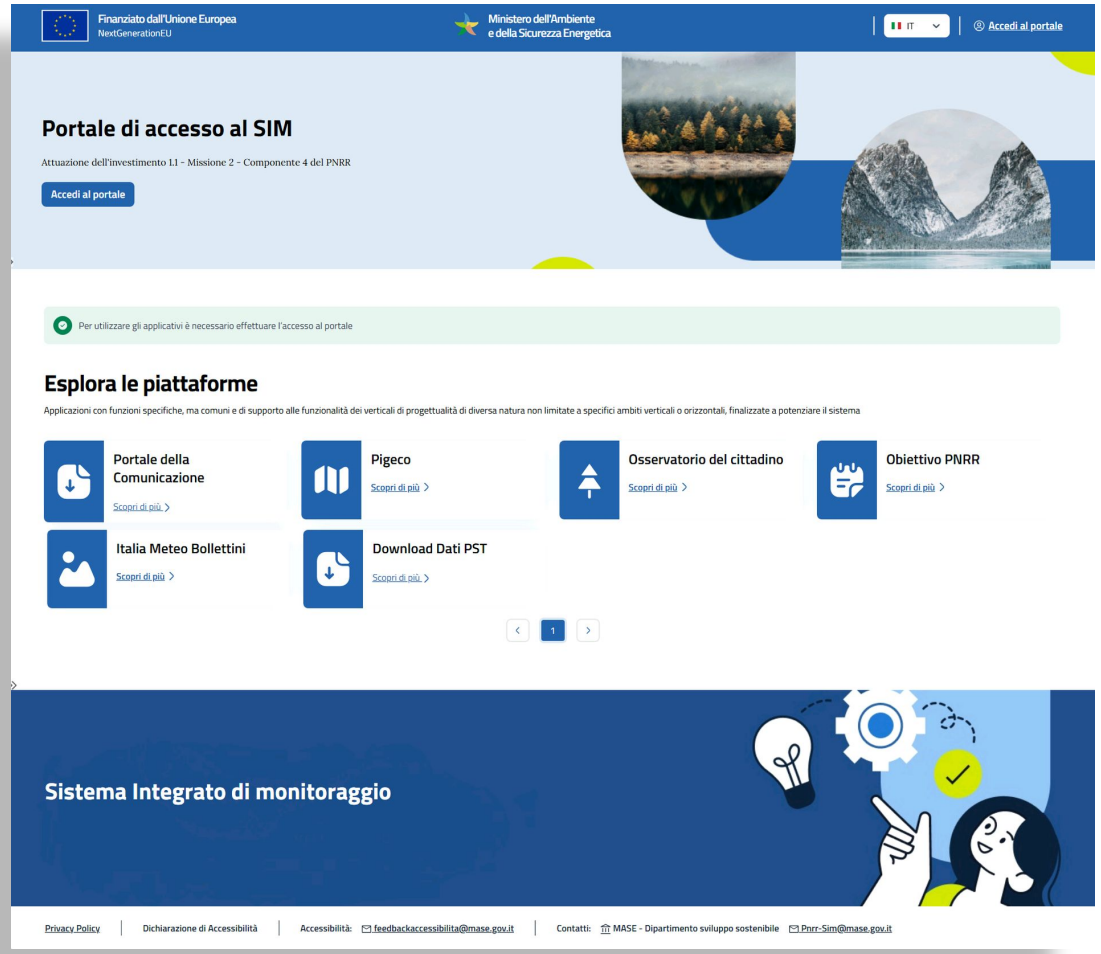
INBO
International Network of Basin Organizations

Parma *19 maggio 2025*

MINISTERO DELL'AMBIENTE
E DELLA SICUREZZA ENERGETICA

SIM | SISTEMA INTEGRATO DI MONITORAGGIO E PREVISIONE – OVERVIEW



The **Integrated Long-term Monitoring and Forecasting System (SIM)**, referred to in the **PNRR Investment M2C4M1_I.1.1**, is intended to implement preventive measures for the **planned maintenance of the Italian territory and the maintenance/modernisation of infrastructures**, as well as to support at a national, regional and local level the continuous knowledge of the environment and the territory in order to **direct interventions aimed at preventing the risks of climate change** on six main topics of interest

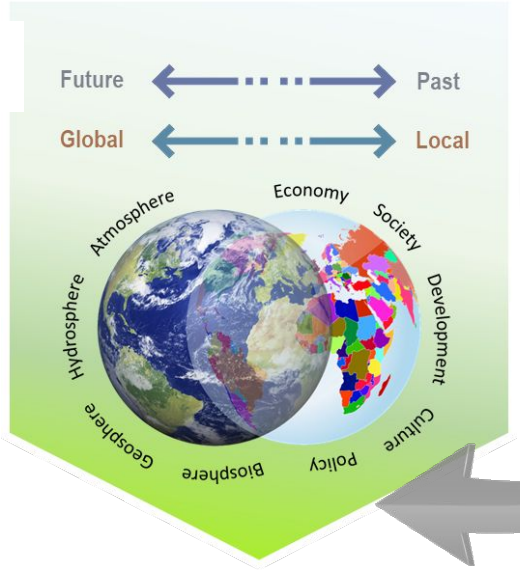
- **Hydrogeological instability**
- **Precision agriculture**
- **Marine and Coastal Pollution**
- **Environmental offences**
- **Emergency support**
- **Forest and Interface Fires**

SIM | DIGITAL EARTH & SIM

Society

Science

Technology



Bodies of Knowledge space

Co-creation & Communication

- Scientific discovery
- Technical innovation
- Decision making
- Knowledge dissemination

SIM

BD

Intelligence generation

IoT

Computing virtualization (Cloudification)

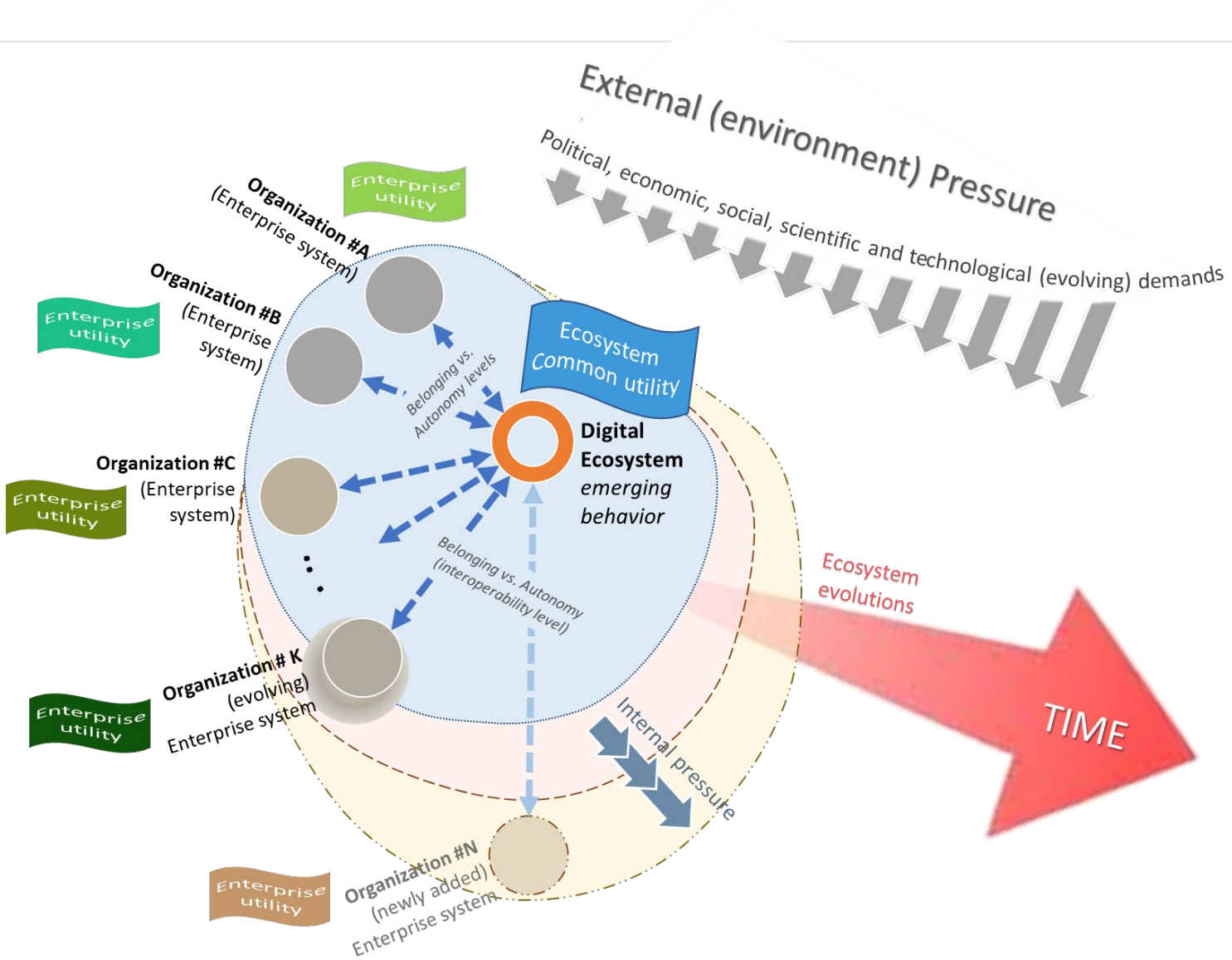
5G/6G

Datafication/social sensing

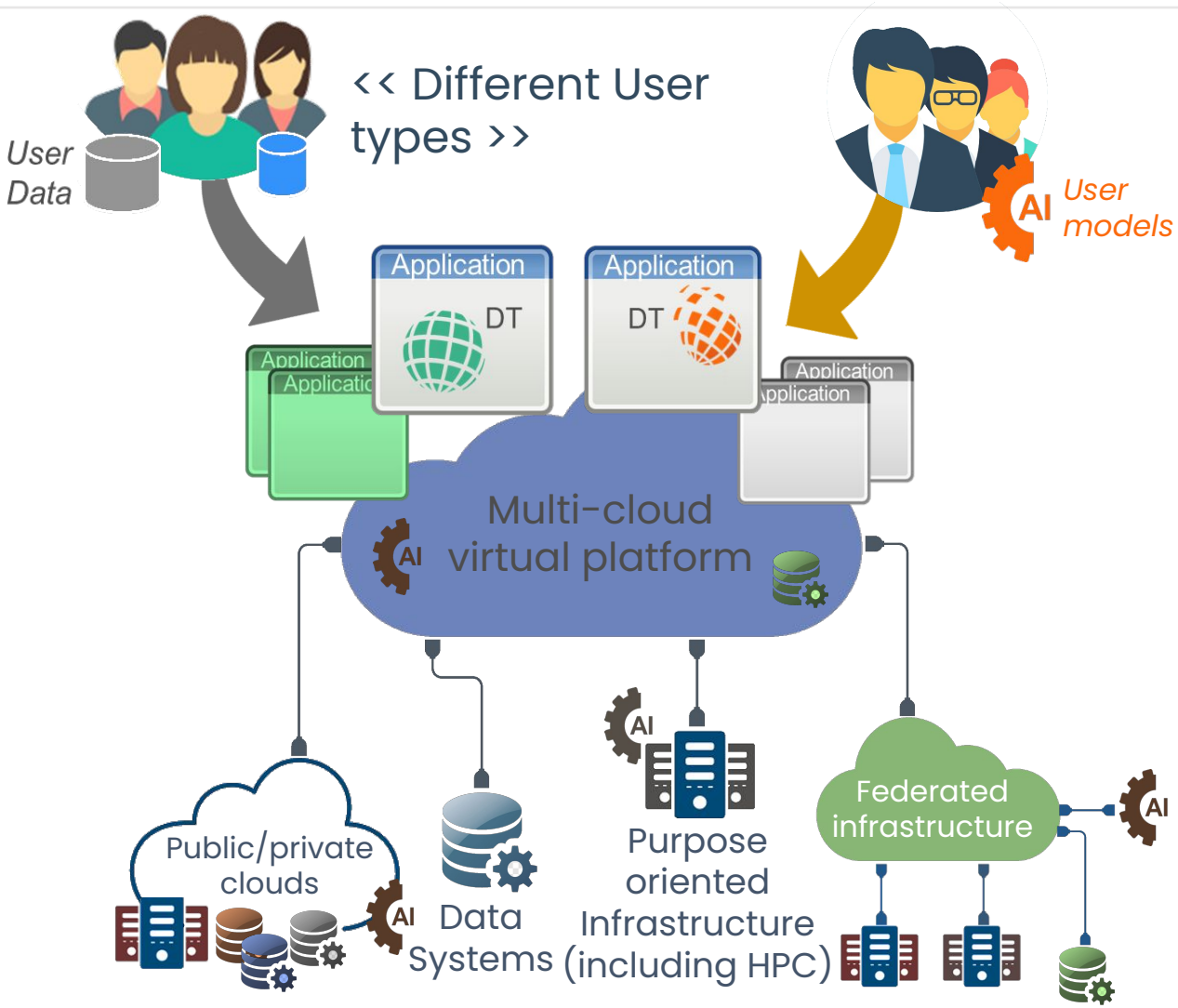
Narrow AI

Ubiquitous connectivity

SIM | A HIGHLY DYNAMIC SYSTEM



SIM | A DIGITAL ECOSYSTEM FOR A DIGITAL TWIN



- A systems' system made up of enterprise systems
- Internet is the ecosystemic environment
- Sharing and Orchestration of Digital Resources.
- Provides open scalability (Multi-cloud)

SIM | PROCUREMENT STARTUP – TENDERS

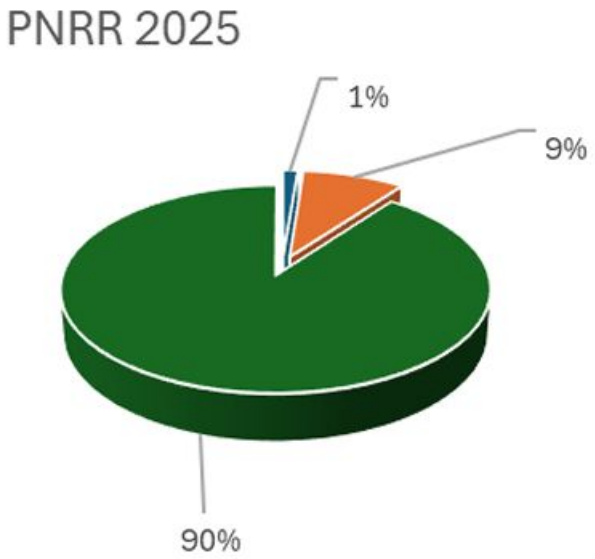
Interinstitutional agreements between MASE, Central Government Agencies and Administrations and Regions to their needs expressed have been signed. A procurement strategy has been identified, including a series of acquisitions through **tender procedures**, and additional purchases to be made through **Consip (Italian PA contract) tools.**

Tender procedures	Supply description	Amount	AS Is
1 Monitoring Networks	Development and implementation of advanced sensor networks for environmental and infrastructure monitoring, with real-time data collection for prevention of associated risks	***260.203.995 €***	*Stipulated Framework Agreement* *Check thecnical documentation in progress*
2 DTM/LiDAR	Use of remote sensing technologies, such as Digital Terrain Model (DTM) and Laser Imaging Detection and Ranging (LiDAR), for high-precision land mapping, and purchase of kinematic gravimeter sensors for aerogravimetric surveys	***35.000.000 €***	*Chronoprogram and Verification Protocol approved* *Started Execution*
3 Rete radio incendi	Radio communication systems aimed at supporting firefighting management and ensuring safe and timely transmission of operational information	***30.355.286 €***	***Preliminary stage:*** *finalization confirmation of requirements, expected closure in June 2025*
4 Veicoli	Specialized vehicles for monitoring, intervention and emergency management operations across the Italian territory	***458.380 €***	***Preliminary stage:*** *finalization confirmation of requirements, expected closure in May 2025*
Started		Tot. ***326.017.661 €***	
Equipment	Equipment, instrumentation, supplies	***15.801.783 €***	*Activation order in progress*

Target M2C4-9 June 2025

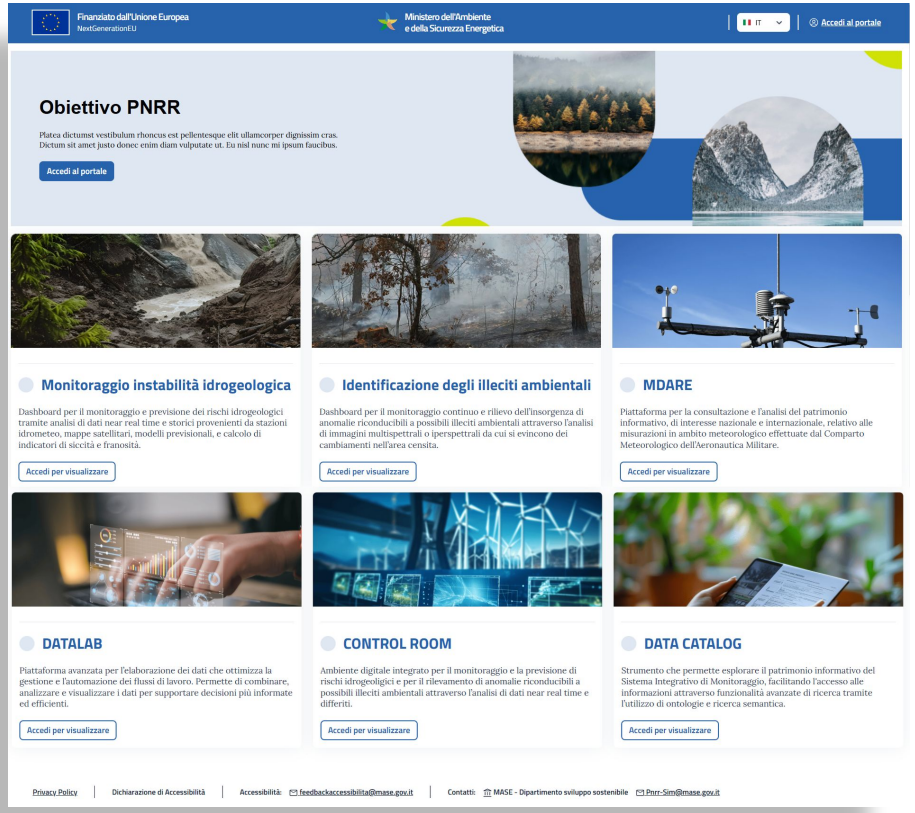
According to the **M2C4-9 investment target**, the monitoring system will have to cover at least 90 per cent of the territory of the southern Italian regions through the integration of existing information systems for monitoring illegal waste management and hydrogeological instability both in real time and deferred and will have to be operational and usable by the second quarter of 2025.

Dataset Ingestion for Target



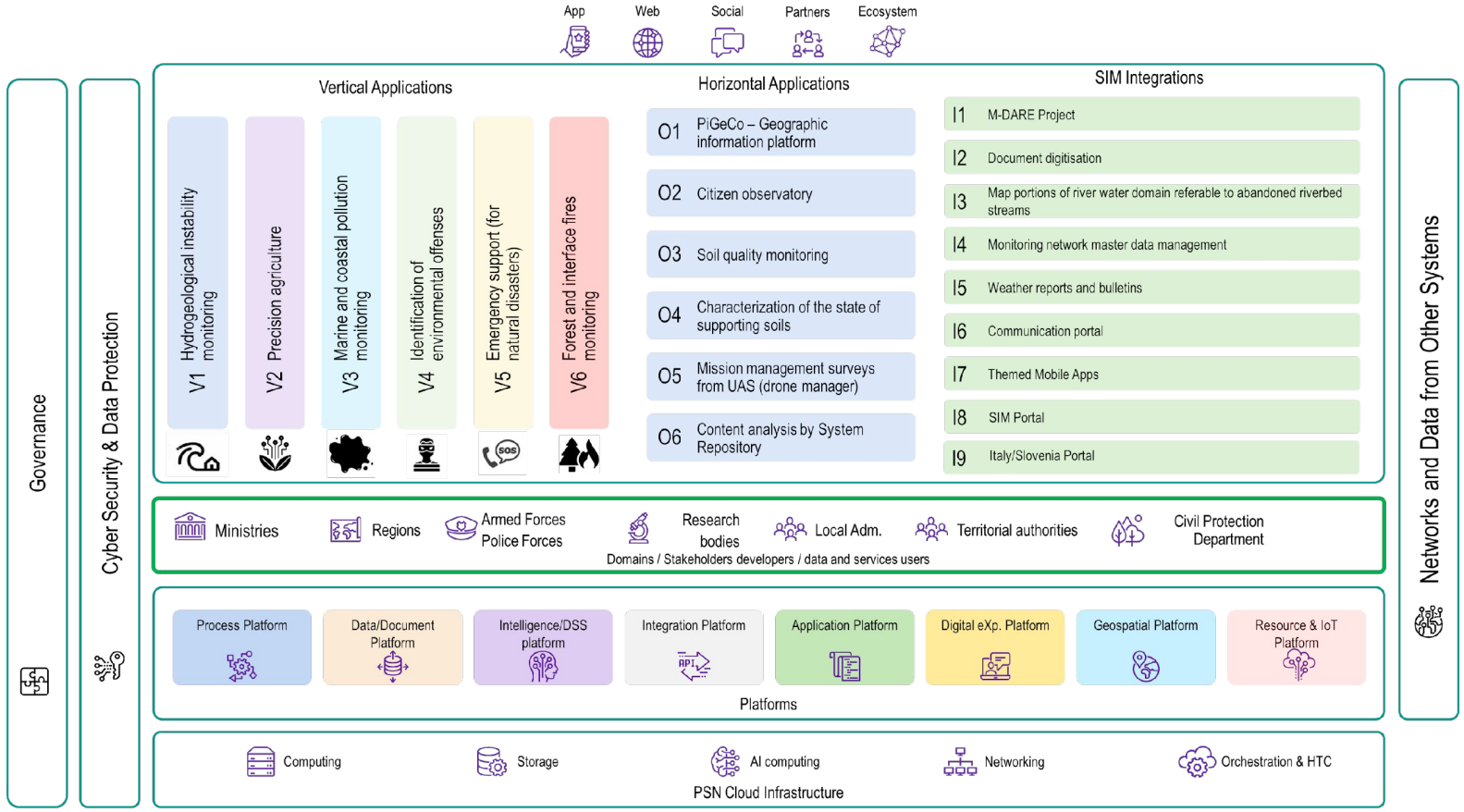
A document is being finalized that specifies in detail the methods and tools with which the SIM Project intends to achieve the Target.

Application MVP Target development underway

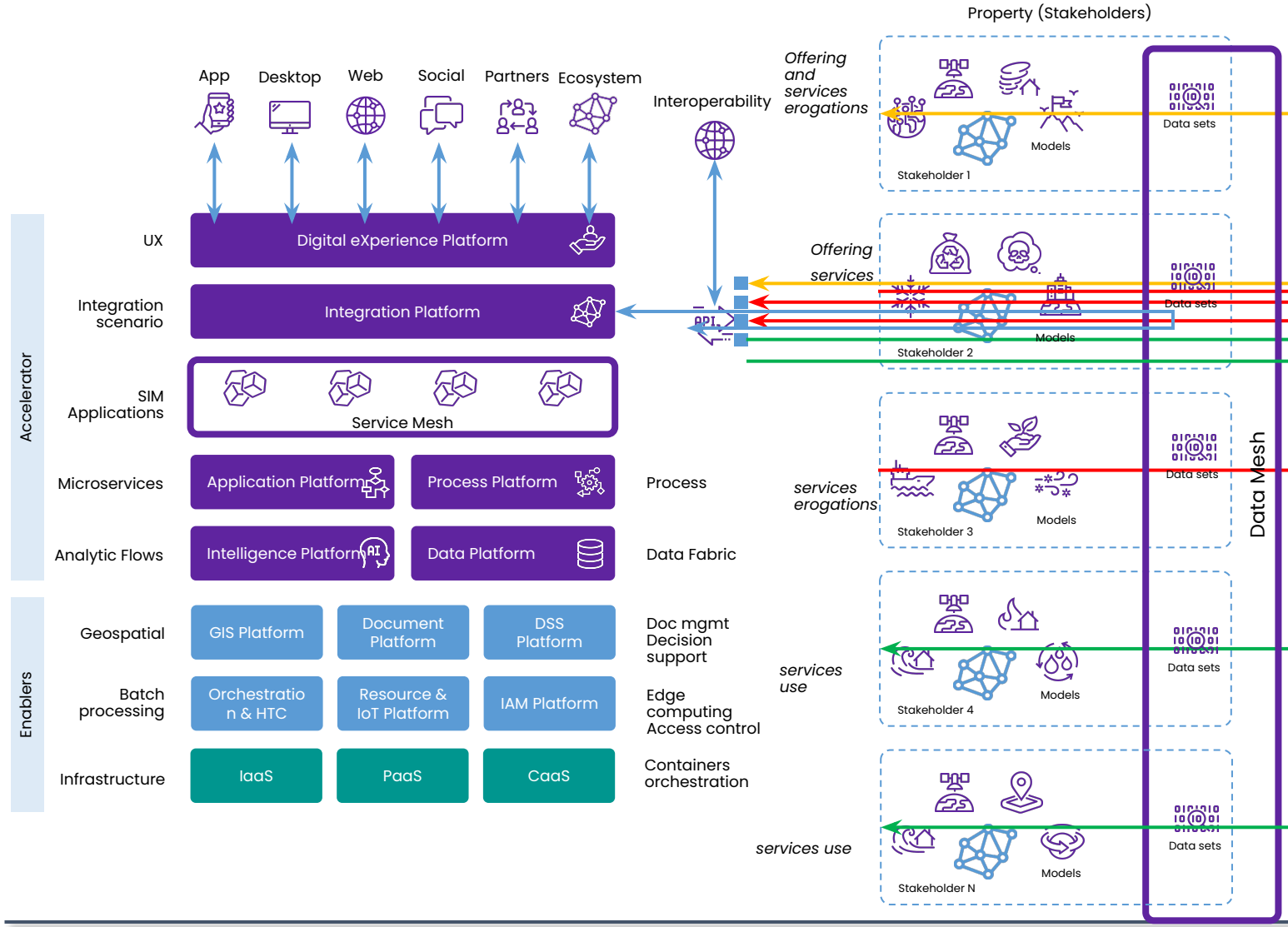


SIM | LOGIC MODEL

One of the main elements of the new SIM System is the functional **architectural model** identified to deliver all the planned services, and which represents one of the strengths of the system in terms of technological innovation and the breadth and variety of information processed. A summary view of the **layers** and the main **components of the SIM's logical architecture** is given alongside



SIM | ARCHITECTURAL MODEL



The architectural model underlying SIM architectures is the Digital Integration Hub (DIH) model.

The DIH plays a crucial role in orchestrating data, models, and applications within an organization that is distributed by nature, fostering connectivity between systems, collaboration between teams, and digital innovation.

For SIM, at the architectural level, a series of components have been developed that are closely related and integrated with each other and play a distinct role in the architecture.

The data remain the property of the entities that make them available through the interoperability arrangements provided for in the Digital Code (AGID/DTD).

SIM | VERTICAL APPLICATION SYSTEMS

Vertical 1

SIM | Verticale 1 – Hydrogeological instability

Vertical 2

SIM | Vertical 2 – Precision agriculture

Vertical 3

SIM | Vertical 3 – Marine and Coastal Pollution

Vertical 4

SIM | Vertical 4 – Environmental offences

Vertical 5

SIM | Vertical 5 – Emergency support

Vertical 6

SIM | Vertical 6 – Forest and Interface Fires

SIM | HORIZONTAL APPLICATION SYSTEMS

Below are some horizontal applications that cover heterogeneous topics and consequently fall outside the vertical categorization

PiGeCo

Soil Quality Monitoring Service

Soil State Characterization

Content analysis by Repository (RS)

Citizen's Observatory

UAS (drone manager)

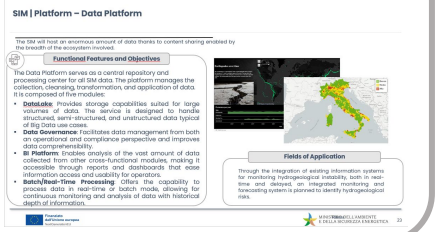
SIM | INTEGRATIONS TO THE SIM PLATFORM

Below are some projects that include integrations to the SIM platform

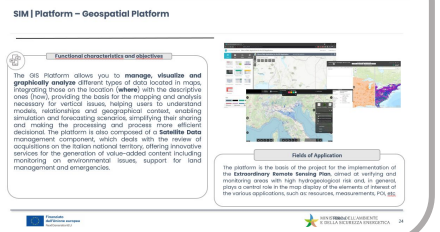
- M-DARE Project
- Document digitisation
- Map of portions of river water domain referable to riverbed abandoned by watercourses
- Monitoring network master data management
- Weather bulletins and report
- SIM communication portal
- Thematic mobile apps
- SIM access portal

SIM | PLATFORMS

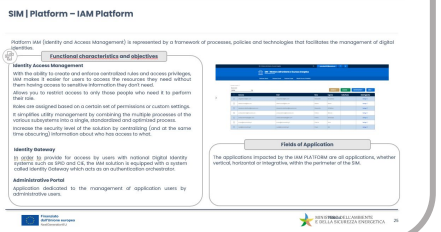
Data Platform



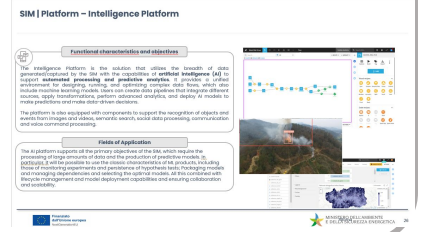
Geospatial Platform



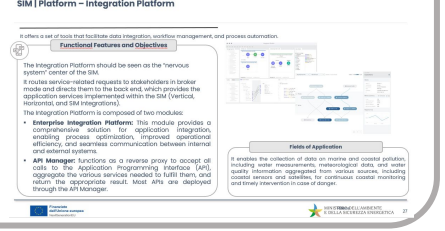
IAM Platform



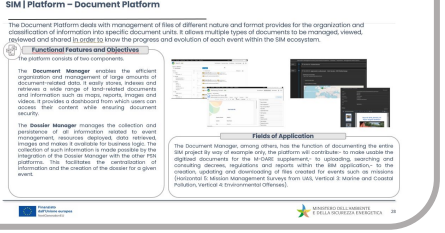
Intelligence Platform



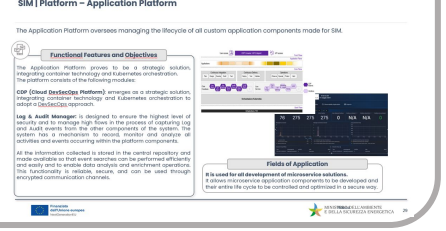
Integration Platform



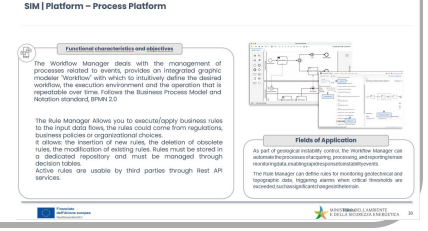
Document Platform



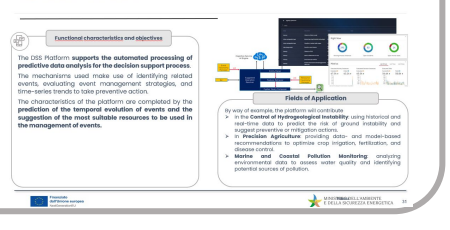
Application Platform



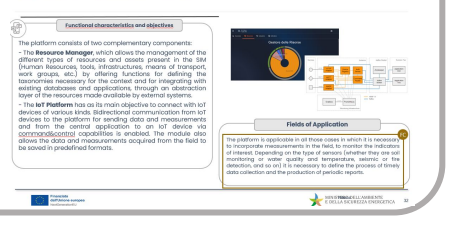
Process Platform



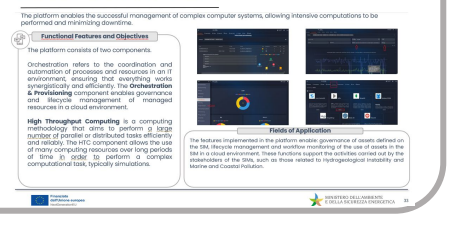
DSS Platform



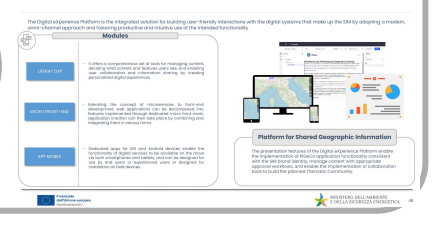
R&IoT Platform



O&HTC Platform



DE Platform



SIM | The role of the project in enacting EU Water Framework Directive

Among the SIM Use Cases that make a significant contribution to the enaction of the Directive, it is worthy to mention

SIM

Use Case 1.2. – *"Extraction and analysis of geomorphological features of watershed"* (that analyses the dynamics and physical characteristics of water resources)

Use Case 1.10. – *"Estimation of flood flow frequency regime and the effects of climate and spatial change"*

Use Case 1.11 – "Calculating Indicators for Drought and Water Scarcity Assessment"

Applications

Use Case 1.12 – *"Water Plan Dashboard"* – the SIM allows to give a picture of the state of the water resource and the interventions prepared for its protection.

Use Case 2.2 – *"Request irrigation advice"*, it will provide a tool for estimating irrigation resource consumption allowing a reduction of inputs both in terms of water resource and inputs of chemicals.

Vertical 3 - *"Marine and Coastal Pollution"* will guarantee monitoring of water quality, status of marine ecosystems, and short-term forecasting of key contamination variables.

SIM | CU.V1.1 - National Atlas of Watercourse Crossing Infrastructure and Hydraulic Works

Objective : Creation of a comprehensive national atlas of watercourse crossing infrastructures and hydraulic and slope works .- Geographically map all crossing infrastructures and hydraulic and slope works.
- Maintain the atlas updated over time, constantly integrating new data.
- Consolidate Existing Data
- Consolidate Existing Data- Ensure Data Consistency and Validity

Input

- Catchment perimeters
- Maps indicating hydrogeological risk areas
- Satellite imagery for monitoring and hydrogeological derivative products
- Orthophotos
- Hydrogeological risk mitigation interventions

Process

- Extraction of information for survey works Hydraulic Defence

Output

- Map of Watercourse Crossing Infrastructure and Hydraulic Works
- Map of Slope Works
- Archive of Infrastructures and Works
- Survey sheets for the census of crossing infrastructures, hydraulic works and slope works
- Selectable data of interest (e.g. embankments, intake works, drains...) to be used as input for hydrological and hydraulic models

Graphic example

SIM | CU.V1.10 – Estimation of flood flow frequency regime and the effects of climate and spatial change

Objective :

Objective is to enable the Authorities in charge to use the Data Catalog and computational capabilities of SIM to:

- Characterize the frequency regime of flood flows through probabilistic analyses based on return time values.
- Evaluate the effects of climate and spatial changes on key hydrological variables over time and space.
- Provide support to relevant agencies with products, data, and tools for the effective monitoring and management of critical hydrological events.

Input

Hydrographic basin perimeters Maps indicating areas of hydrogeological risk

- HIS (Hydrologic Information System) Central for sharing hydrometeorological data.
- Drought Bullettins (SPI Index)
- Output data from other CUs: 1.1, .1.2, 1.4, 1.5, 1.6, 1.7, 1.9.

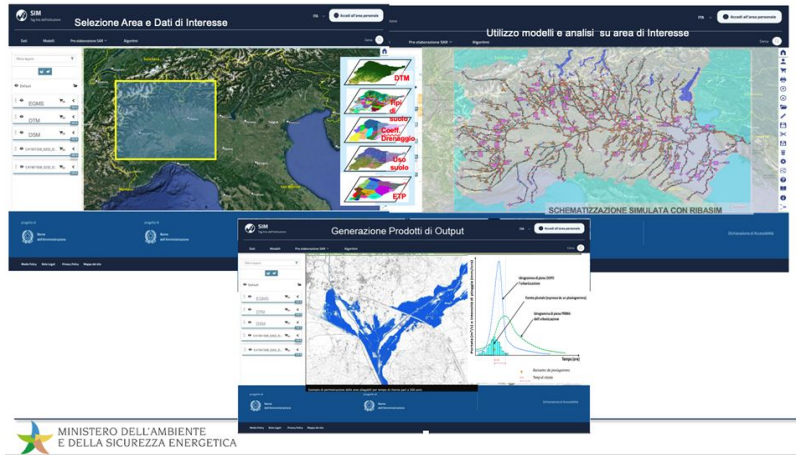
Process

- Consultation, visualization, and extraction of existing information on area of interest as input for models
- Consultation, visualization and extraction of existing information on a specific area of interest
- Consultation, visualization and extraction of existing information on a specific area of interest and use of models/algorithms (e.g., ANÁBASI, AUTOIDRO, GEOFRAME, DREAM) for flood flow regime estimation

Output

- Flood flows in the selected river section of interest.
- Flood hydrograms on selected river section of interest.
- Extreme rainfall on selected area of interest.
- Flood areas for an assigned return time on selected area of interest.

Graphic example



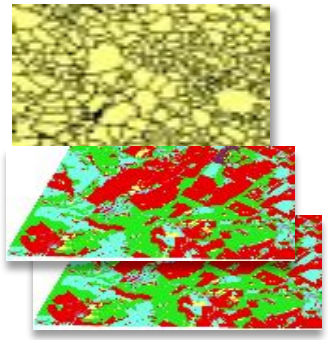
SIM | CU.V4.2 – Land consumption for monitoring changes from natural to artificial and from artificial to artificial

Objective : To provide a tool for **developing maps of land cover change**, both **in the direction of natural soil loss and gain**, and geographic and statistical computations aimed at returning summary pictures.

SCENARIO

INPUTS

- **Administrative boundaries**
- **Land cover maps**

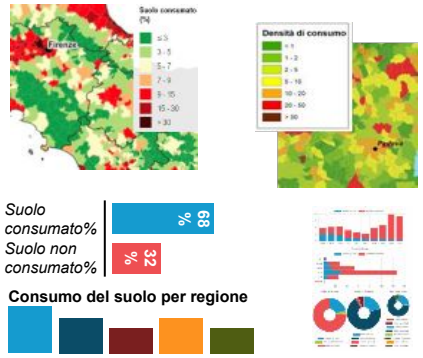


ALGORITHMS

- **Analysis area selection(AOI/ Time Instants)**
- **Change Detection**
  - **On-Demand**
  - **Automation**
  - **Multi-temporal**
- **Statistics**

OUTPUTS

- **Land consumption: maps & geographic processing.**
- **KPIs**



EXPECTED FEATURES

Parameter arrangement
- Selection of processing type (standard, automated, multitemporal)
- Selection of processing statistics
- Definition of Survey Area
- Access and selection of input data
- Upload by User (Expert)

Processing Algorithms
- Encoding remapping tool
- Change Detection
- Multitemporal change detection
- Statistical processing
- Vectorization and generalization (smoothing)
- Mobile Window

Output Management
- Access output products:
  - Land cover change map
  - Statistical processing
  - Implementation status reports
- Sharing in the Master Catalog (Expert)
- Validation Management
- Administrative Process Management (Expert)

Finanziato dall'Unione europea
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GO BACK TO V4

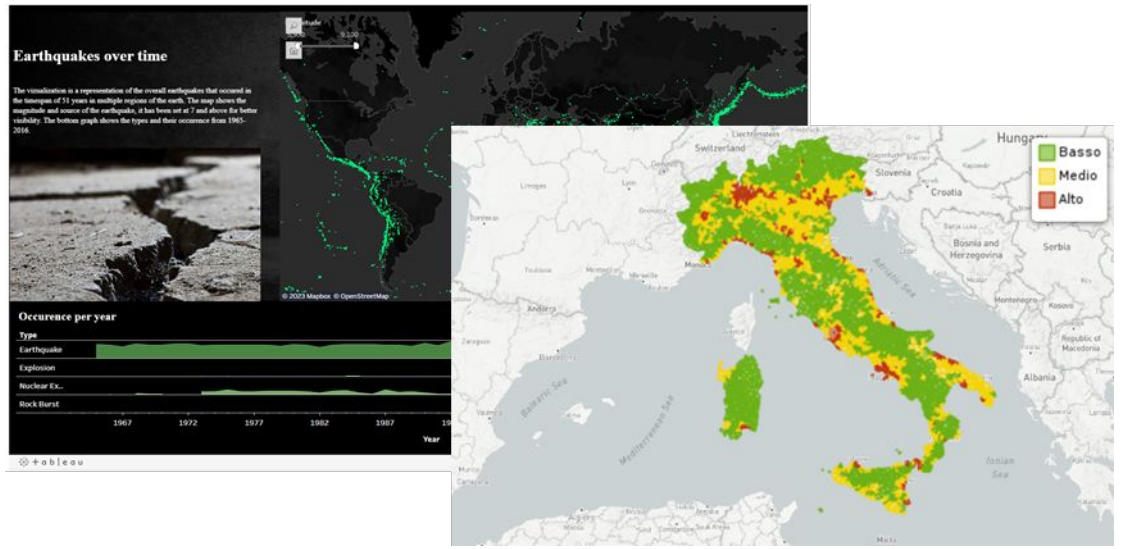
SIM | Platform – Data Platform

The SIM will host an enormous amount of data thanks to content sharing enabled by the breadth of the ecosystem involved.

Functional characteristics and objectives

The Data Platform serves as a central repository and processing center for all SIM data. The platform manages the collection, cleansing, transformation, and application of data.
It is composed of five modules:

- **DataLake**: Provides storage capabilities suited for large volumes of data. The service is designed to handle structured, semi-structured, and unstructured data typical of Big Data use cases.
- **Data Governance**: Facilitates data management from both an operational and compliance perspective and improves data comprehensibility.
- **BI Platform**: Enables analysis of the vast amount of data collected from other cross-functional modules, making it accessible through reports and dashboards that ease information access and usability for operators.
- **Batch/Real-Time Processing**: Offers the capability to process data in real-time or batch mode, allowing for continuous monitoring and analysis of data with historical depth of information.



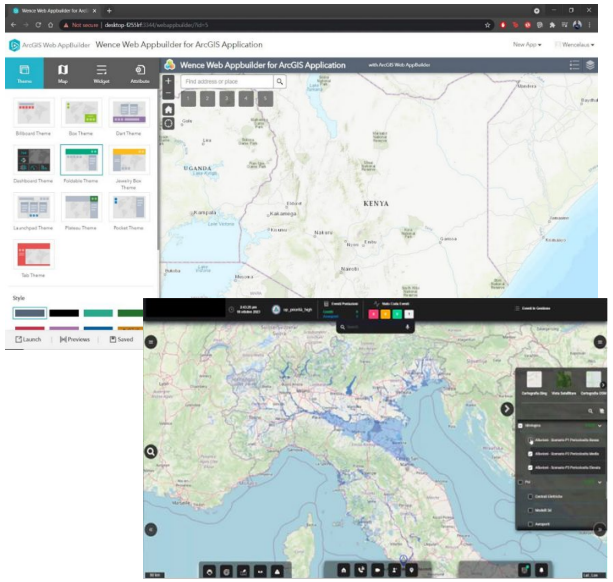
Fields of Application

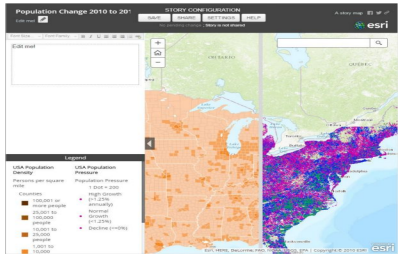
Through the integration of existing information systems for monitoring hydrogeological instability, both in real-time and delayed, an integrated monitoring and forecasting system is planned to identify hydrogeological risks.

SIM | Platform – Geospatial Platform

Functional characteristics and objectives

The GIS Platform allows you to **manage, visualize and graphically analyze** different types of data located in maps, integrating those on the location (**where**) with the descriptive ones (how), providing the basis for the mapping and analysis necessary for vertical issues, helping users to understand models, relationships and geographical context, enabling simulation and forecasting scenarios, simplifying their sharing and making the processing and process more efficient decisional. The platform is also composed of a **Satellite Data** management component, which deals with the review of acquisitions on the Italian national territory, offering innovative services for the generation of value-added content including monitoring on environmental issues, support for land management and emergencies.





Fields of Application

The platform is the basis of the project for the implementation of the **Extraordinary Remote Sensing Plan**, aimed at verifying and monitoring areas with high hydrogeological risk and, in general, plays a central role in the map display of the elements of interest of the various applications, such as: resources, measurements, POI, etc.

SIM | Platform – Intelligence Platform

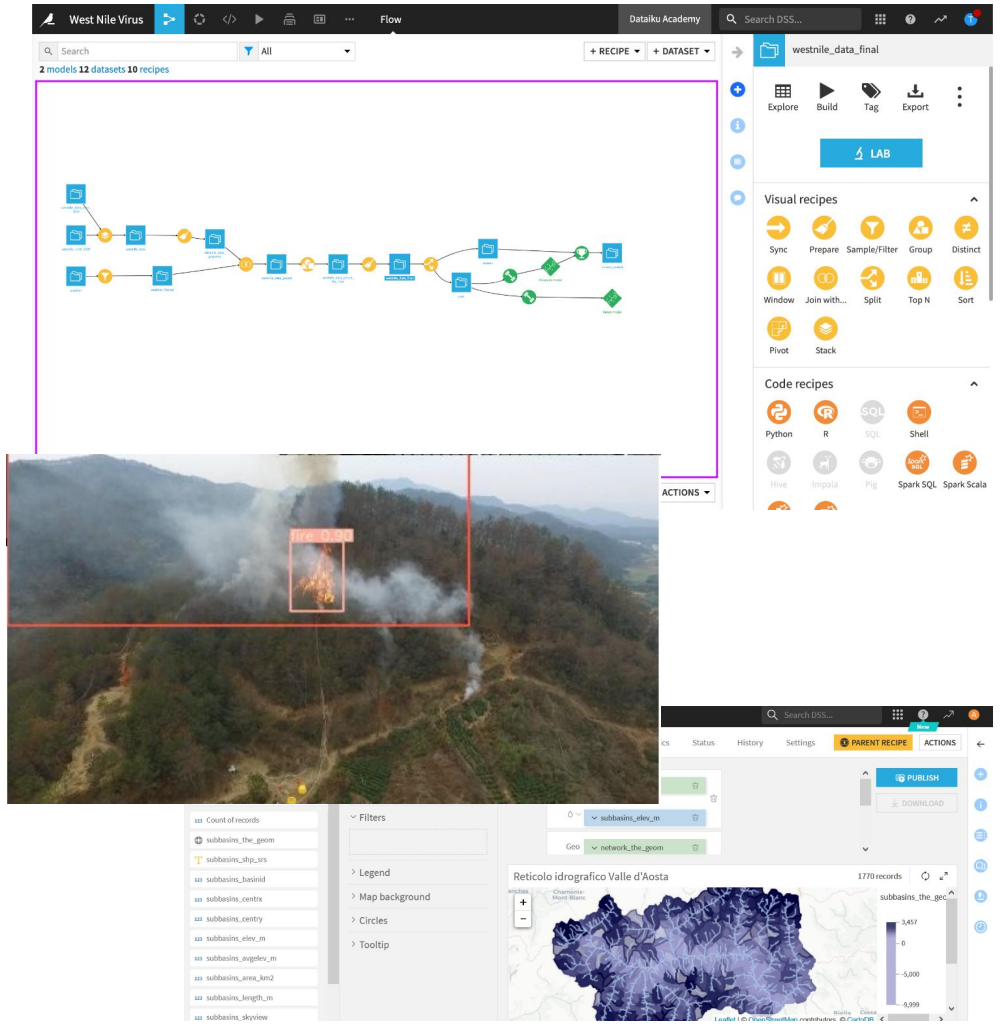
Functional characteristics and objectives

The Intelligence Platform is the solution that utilizes the breadth of data generated/captured by the SIM with the capabilities of **artificial intelligence (AI)** to support **automated processing and predictive analytics**. It provides a unified environment for designing, running, and optimizing complex data flows, which also include machine learning models. Users can create data pipelines that integrate different sources, apply transformations, perform advanced analytics, and deploy AI models to make predictions and make data-driven decisions.

The platform is also equipped with components to support the recognition of objects and events from images and videos, semantic search, social data processing, communication and voice command processing.

Functional characteristics and objectives

The AI platform supports all the primary objectives of the SIM, which require the processing of large amounts of data and the production of predictive models. In particular, it will be possible to use the classic characteristics of ML products, including those of monitoring experiments and persistence of hypothesis tests; Packaging models and managing dependencies and selecting the optimal models. All this combined with lifecycle management and model deployment capabilities and ensuring collaboration and scalability.



C.U. 6.4 – Sistema di addestramento immersivo (FFAS) – MVP1/MVP2

Obiettivo e Stato dell'Arte

Obiettivo primario è quello di fornire un sistema per la formazione e l'addestramento degli Enti Competenti, i quali ai sensi della normativa vigente sono impiegati in attività di repertazione tecnica sui soprassuoli boschivi percorsi dal fuoco e di lotta attiva agli incendi boschivi e di interfaccia.

È stata completata la fase di analisi con il consolidamento del Piano di Lavoro e avviata la fase di realizzazione, che prevederà 6 rilasci (MVP), che saranno oggetto di **verifica tecnica da parte del GdS, dei quali il primo effettuato in data 18 Dicembre 2024 e il secondo in data 26 Febbraio 2025. Il Prossimo rilascio è pianificato per Maggio 2025.**

FUNZIONALITÀ PREVISTE

- **Interfaccia per l'addestratore;**
  - L'addestratore potrà configurare le opzioni di partenza e variare alcuni aspetti nel corso della simulazioni.
- **Simulazione;**
  - Simulazione dotazioni e Simulazione centrali operative.
- **Motore grafico 3D;**
  - Il motore grafico prevedrà il rendering 3D dei modelli di specie vegetali ed il rendering 3D degli scenari di addestramento.
- **Moduli Formativi;**
  - Propagazione Incendi, Dissesto Idrogeologico, Investigazione post Incendio, Didattica riconoscimento specie forestali, Valutazione stato Fitosanitario della foresta e Incendi di interfaccia urbano-rurale.
- **Funzioni, Algoritmi e Modelli;**
  - Saranno adottati algoritmi e modelli matematici consolidati in ambito applicativo o derivanti da lavori scientifici pubblicati e/o presentati a convegni internazionali.
- **Integrazione sistemi;**
  - Componente software di integrazione/comunicazione fra motore grafico 3D e modelli matematici di simulazione del fuoco.
- **Palestre Virtuali**
  - Le palestre (11) rappresentative dei diversi ecosistemi resi disponibili.

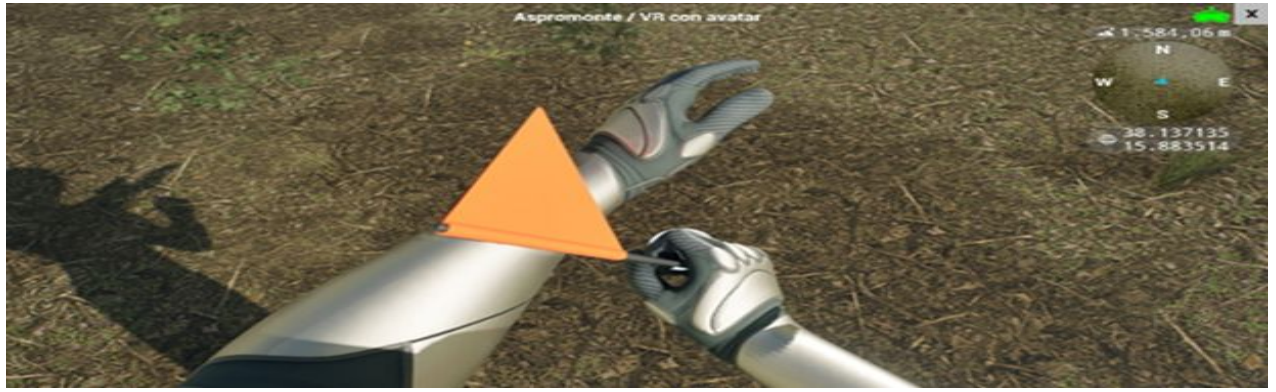
C.U. 6.4 – Sistema di addestramento immersivo (FFAS) – MVP1/MVP2

Nelle immagini vengono riportate alcune funzionalità rese disponibili nelle 11 Palestre costruite.

Gestione immersiva Multi-user con seguenti funzioni:

- Interfacciamento strumenti/inventario:
  - **Bandierine rosse NIAB**.
    - Le bandierine vengono posizionate sul suolo per tracciare segni di passaggio del fuoco al fine di ripercorrere le fiamme fino al loro punto di innesco.
    - Vengono utilizzate nel modulo formativo di «Investigazione Post Incendio».
  - **Ricevitore GNSS.**
    - Strumento Utilizzato in tutte i moduli del simulatore al fine di fornire un servizio di posizionamento geo-spaziale che consente di determinare le coordinate geografiche (longitudine, latitudine ed altitudine) su un qualunque punto della mappa.

GNSS



Bandierina Rossa - NIAB

C.U. 6.4 – Sistema di addestramento immersivo (FFAS) – MVP1/MVP2

Nelle immagini vengono riportate alcune funzionalità rese disponibili nelle 11 Palestre costruite.

Gestione immersiva Multi-user con seguenti Elementi Antropici:

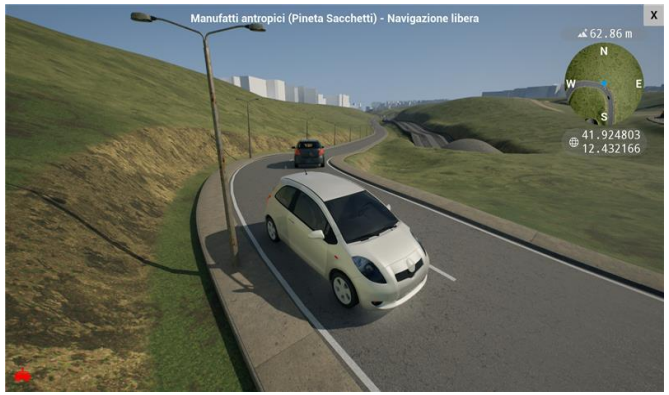
1. Auto.
2. Ferrovia.
3. Bombole del GAS.
4. Tunnel.
5. Ponti.
6. Lampioni.

Questi elementi sono definiti per lo più all'interno delle palestre dedicate agli incendi di interfaccia Urbano-Rurale, quali:

- **Pineta Sacchetti.**
- **Castellaneta Marina.**
- **Monte Bignone.**

Tunnel

Bombole GAS – Pineta Sacchetti



Automobile e Lampione

Ferrovia con tunnel

C.U. 6.4 – Sistema di addestramento immersivo (FFAS) – MVP1/MVP2

Nelle immagini vengono riportate alcune funzionalità rese disponibili nelle 11 Palestre costruite.

Gestione immersiva Multi-user con seguenti Funzionalità in navigazione Libera

1. Pilotaggio velivoli (Droni/Elicotteri/Aereo).
   - In tutte le palestre è possibile da parte del DOS/DTS sorvolare le aree rappresentate con un velivolo virtuale. Tale funzionalità non implementa un simulatore di volo ma una modalità di pilotaggio semplificato che permette all'allievo di sorvolare l'area e scattare foto significative di contesti. Il ruolo specifico per il pilotaggio del Velivolo è il ruolo immersivo **PILOTA**.
2. Impostazioni data e ora con definizione luminosità.
3. Impostazioni intensità e direzione del vento.
4. Nuvole.

Queste impostazioni vengono definite in fase di configurazione della simulazione ma posso essere variate nel corso della simulazione.

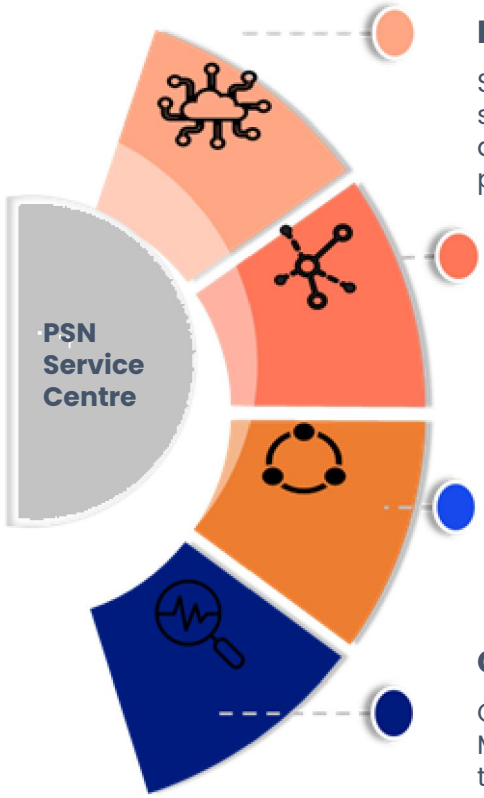
Pilotaggio Drone

Pilotaggio Elicottero

Impostazione data, ora, Intensità e direzione Vento con nuvole

Pilotaggio Candair

SIM | CYBER SECURITY AND DATA PROTECTION



Evolved

Strong Cyber Defence Capabilities to enable maximum security resilience through advanced services, anticipating the most complex attack trends where possible

Advanced

Capacitive streams for the continuous improvement of security services aimed at raising the level of resilience of the MASE and responding to advanced cyber attacks

Based

Application of defensive capabilities aimed at ensuring the appropriate reactive and proactive capabilities in line with the main industry best practices and regulations

Core

Check the initial security scenario;
Monitor posture in the transient and in compliance with the MASE safety baseline

- Security Event Monitoring Notification, Log Management e Continuos Improvement;
- Security Orchestration, Automation and Response;
- Incident Management & Crisis Management;
- Cyber Threat intelligence:
  - Early Warning,
  - Data Breach,
  - Brand Abuse,
  - Anti-Pishing with site takedown,
  - Pre Planned Attack + Black Market Monitor

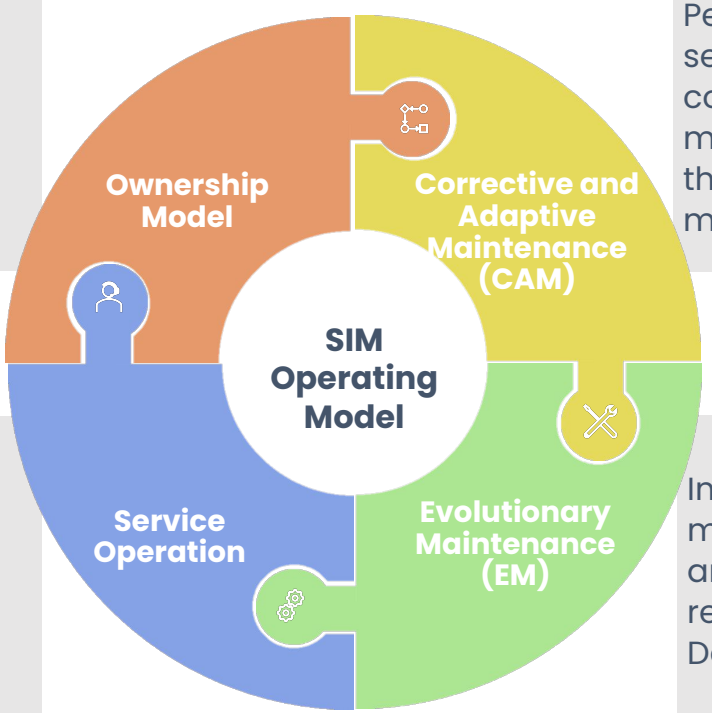
- Security Device Management;
- Security Hosts (Managed Detection & Response);
- Threat Hunting as a Service;
- Compliance Assessment Framework National Cyber Secutiry (FNSC);
- Cyber Strategic Risk Management;
- Support for Security by Design (gap-analysis Security controls aimed at protecting the network, services and end points;

- Vulnerability Management;
- Dynamic Application Penetration Testing;
- Web Application Penetration Testing;
- Security Policy review/advisor;
- Consulting for Review of Cyber Security policies and procedures
- Maturity Level Assessment and Relative methodology

SIM | GOVERNANCE MODEL

The governance model defines the **key aspects** to ensure a clear and orderly direction in the management and future development of the integrated monitoring system. It will be able to govern the management and evolution of the SIM. This model sees the MASE as the main actor, with the role of central oversight and governance, and actively involves the individual administrations with no less significant responsibilities, in terms of taking charge of the components under their responsibility and requests for any update and evolution activities.

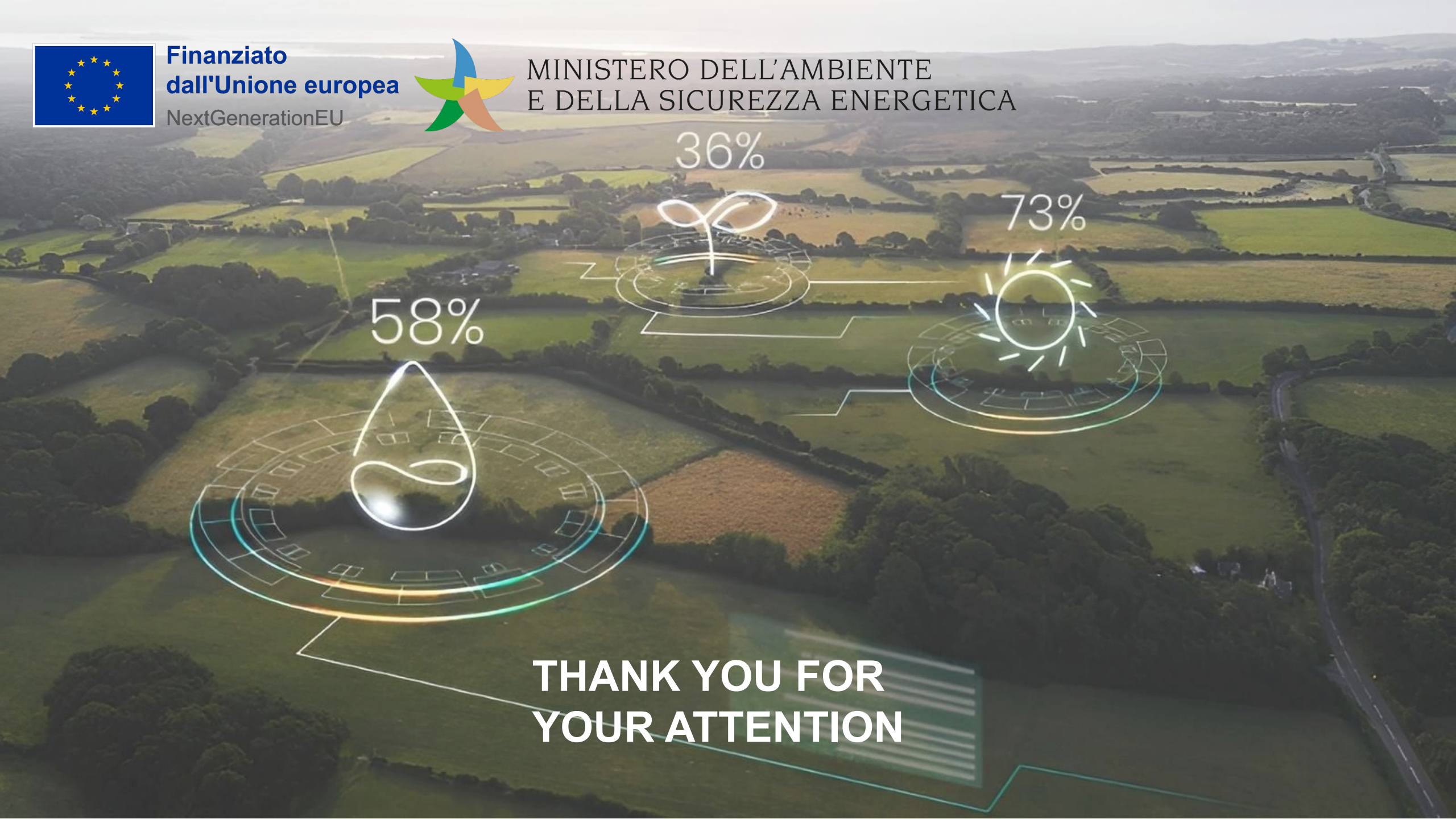
- Definition of responsibilities
- Assignment of authorizations
- Documentation of processes
- Security strategy
- Business continuity planning
- Regular review and audits



Performing emergency actions in the face of service interruptions; correcting code; restoring corrupted database; releasing the correction made into production. CAM can be triggered in the face of user reports (reactive) or by SIM management teams (proactive)

- Incident Management
- Problem Management
- Change Management
- Asset & Configuration Mgmt
- SLA Management
- Service Request

Implementation and deployment of additional, modified and complementary functionality to SIM, and aimed at meeting stakeholder needs. EM requests are managed through a specific Demand Management process.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