



DIGITAL TWIN OF FRANCE AND ITS TERRITORIES

TOWARDS A VIRTUAL TWIN OF FRANCE
AND ITS TERRITORIES

22ND JANUARY 2025

EUROSDR 3D MAPPING AT NMCAS

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VALLET



GIVEN THE COMPLEXITY OF OPTIMIZING
PUBLIC POLICY CHOICES,
IT BECOMES NECESSARY
TO PROJECT INTO THE FUTURE
THROUGH SIMULATION
TO ASSESS THE **FORESEEABLE EVOLUTION**
OF ECOLOGICAL PHENOMENA
AND THE **ANTICIPATED IMPACT**
OF POSSIBLE ACTION SCENARIOS,
THEREBY FOSTERING **A COMMON UNDERSTANDING**

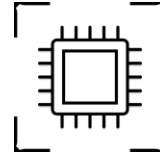
➔ **DIGITAL TWIN OF THE TERRITORY**

CONTEXT



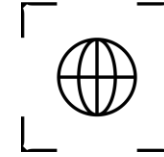
STEERING PUBLIC POLICIES

Search for optimisation and compromise.
The need for data, forecasting tools and mediation in the context of climate change.



DATA & TREATMENT CAPACITIES

In constant growth and progress.
Mature information processing and visualisation technologies (AI, deep-learning, XR, HPC, etc.)



STAKEHOLDERS

Working and contributing to public policy and the green transition
(public services, industry, startups, research, etc.)

OPPORTUNITY

- > **SHARING INITIATIVES** to enable them to scale up, to exchange with each other (systemic vision)
- > **SHARING KNOWLEDGE** bring about change in practice and tools
- > **SHARING COSTS** of research, development and deployment

AMBITION

To build a **COMMON OPEN TECHNICAL ARCHITECTURE**
to support the development of a **NEW INDUSTRY**
around **DIGITAL TWINS OF TERRITORIES**

The projet **consortium gathers** around 15 partners :

- **PUBLIC ORGANIZATIONS (CORE TEAM)**



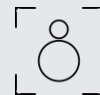
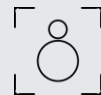
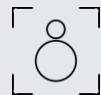
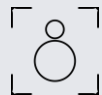
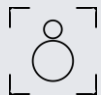
- **GEODIGITAL COMPANIES & INDUSTRIES**



Consortium leader



- **BUSINESS APPLICATIONS COMPANIES**



2nd circle

- **LOCAL AUTHORITIES**
- **USE CASES HOLDERS**
- **STARTUPS AND INNOVATION STAKEHOLDERS**

Foreseen governance

- **STRATEGIC COMITY**
- **INDUSTRIAL COMITY**
- **USERS COMITY**
- **SCIENCE COMITY**

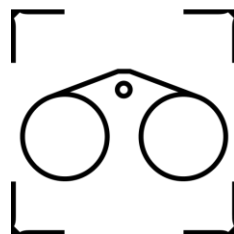
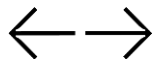
WHAT IS A DIGITAL TWIN OF A TERRITORY?

A DYNAMIC VIRTUAL REPLICA OF THE REGION



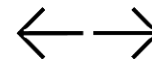
TERRITORY DATA

2D/3D, georeferenced,
topographic, thematic, real-
time...



VISUALISATION / INTERACTIONS

Data interaction services, handling,
immersive navigation, XR



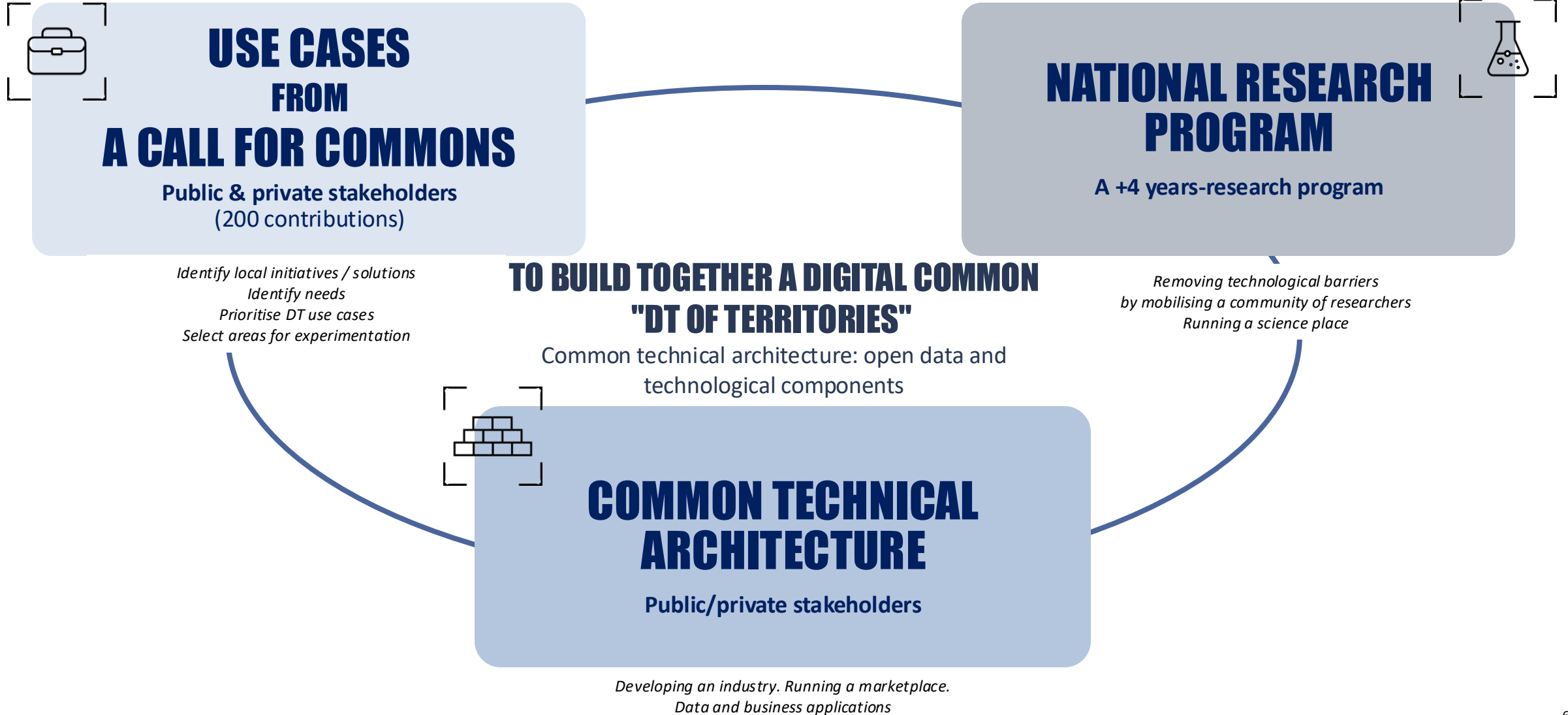
SIMULATIONS

Modelling natural and social
phenomena in response to identified
use cases

TO ANSWER COMPLEX, CROSS-THEMATIC QUESTIONS

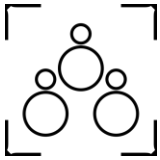
- **Systemic analysis** of scenarios to improve public policy management
- **Scaling up**, overcoming local geographical constraints, pooling resources
- **Science and marketplace** to facilitate access to knowledge and services

THREE COMPLEMENTARY INITIATIVES



CALL FOR COMMONS OPEN APPROACH TO BUILD A COMMUNITY

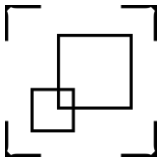
Launched from May to September 2024, the call for commons...



is intended for **AUTHORITIES, RESEARCH LABORATORIES, ASSOCIATIONS OR COMPANIES**



aims at collecting **NEEDS, EXPERIENCE FEEDBACK**
and identifying **SOLUTIONS' PROVIDERS**



in order to **BRING TOGETHER AN ECOSYSTEM** to **SCALE UP** solutions

200
ANSWERS

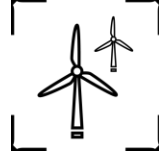
DECEMBER – JANUARY: RESTITUTION EVENTS

GLIMPSE OF TOPICS AND FORESEEN USE CASES

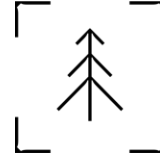
THEME



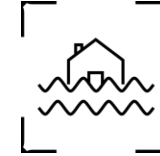
URBAN PLANNING



GREEN PLANNING



ENVIRONMENT



RISKS



HEALTH

TOPIC

#

Urban densification, Land use efficiency, Housing, Transport, Energy, Risks

#

Green and energy transition, Resources, Mobility, Urban nature, Sustainable development

#

Forests, water, biodiversity, resource management, pollution

#

Flooding Submergence Fires Coastal erosion
Weather Climate Heatwaves

#

Epidemiological propagation, quality of life (air, water, environmental noise)

USE CASE



Optimising urban densification in my town



Defining the location of renewable energy spots in my area



Adapting the forest and forest-based industries to global warming



Making my region resilient to natural disasters



Effectively combating against epidemics

FEATURE



- Orchestration of worksites
- Impact studies
- Monitoring land development
- Regulatory simulation
- Sustainable development



- Diagnosis of the area
- Measurement of energy potential
- Monitoring land development
- Development of renewable energy



- Simulation of tree growth, volumes of wood available
- Detection and monitoring of decline / bark beetles
- Simulation and visualisation of forest landscapes



- Heat island simulation
- Submergence, flood and fire simulation
- Coastline recession simulation
- Identification of uninsurable areas



- Crisis management and review
- Simulation of the impact of health measures (class closures, teleworking, etc.)
- Anticipation of hospital workload

USER



Mayors, decentralised government departments, local authorities...



Mayors, decentralised government departments, local authorities...



Forest managers, mayors, economic sector



Mayors, local authorities. Emergency services



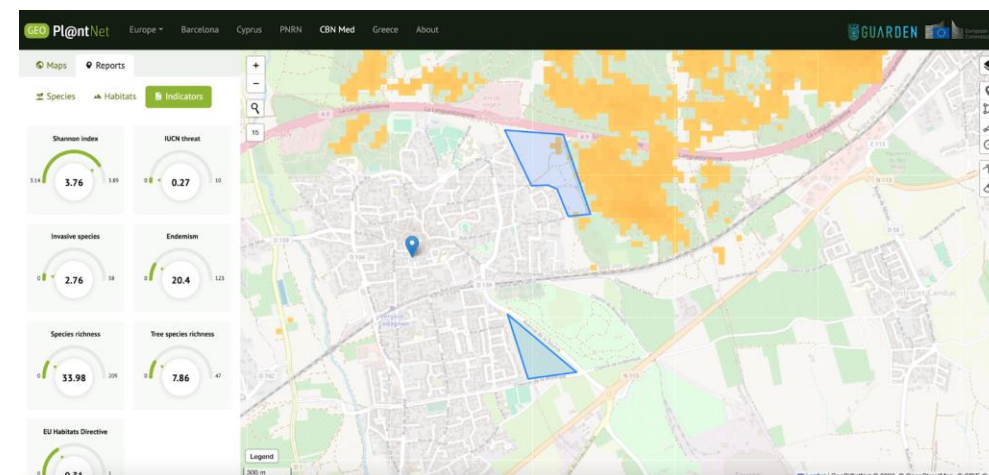
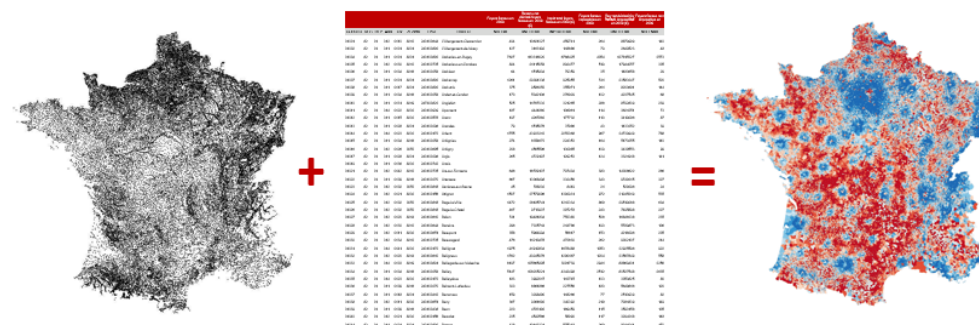
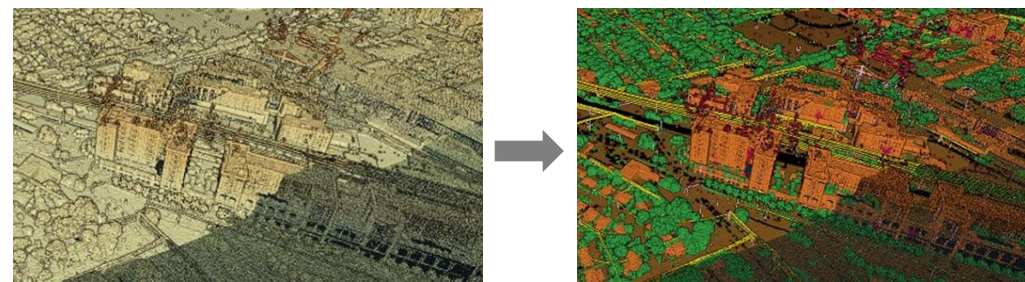
Regional health authorities, emergency services, Hospital federation

OVERVIEW OF SERVICES PROVIDED BY THE DT TO THE USE CASES

- Hosting, broadcasting and indexing **geodata** of various kinds
- Unified **access** to various sources of geodata (API & OGC streams) : weather, socio-economic, hydro, ...
- Simplified access to **simulation models**
- Traceability and indexing of **simulation results**, with documentation
- Realistic **visualisation** capacities (web components, VR connectors)
- Detailed and up-to-date **3D data** (mesh and CityGML), with a nation-wide coverage (based on LiDAR HD) and enriched from more recent local acquisitions (on a voluntary basis)
- Gathering in one platform all **prospective scenarios** (e.g. allowing to merge separate urban planning projects)
- Access to data and services of **local DTs**

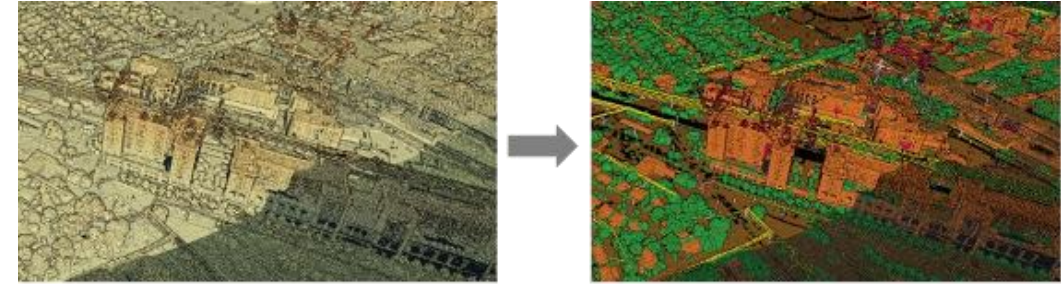
TECHNOLOGICAL CHALLENGES & RESEARCH

- **3D semantic reconstruction of digital twins**
 - Upscaling methods to massive nationwide datasets without seams at tile boundaries. **Frugal** computations and representations.
 - **Panoptic** segmentation of **multi-representations** (point clouds, conic images, ortho images, tri mesh, SIG, CityGML)
 - **Maintenance/updating** with new data with possibly different modality/resolution. Confrontation of new (untrusted) data with DT -> certification (fact checking) or integration (update)
 - **Spatio temporal modeling**. Validity time intervals for each point, pixel, triangle, object...
 - **Diffusion** : optimized and interoperable representations (3DTiles, COG, COPC, gaussian splats...)
- **Integration, interoperability and interconnection of digital twins**
 - Multiplicity of data **sources**, **schemas** and **uncertainty**
 - Variety of integration methods with steep learning curves
 - **Interlinking** : knowledge graph representation and reasoning, linked data, semantic web
 - Ontologies for **interoperability** with DT ecosystems (local DT, nationwide thematic DT, cross-DT update alerts...)



TECHNOLOGICAL CHALLENGES & RESEARCH

- **Research and technology transfer: foundation, openness and use**
 - ICI: massive digital simulation to model the spread of **epidemics** and assess the impact of public interventions
 - GeoPI@ntNet: digital twin of **plant biodiversity** for interactive monitoring and management of biodiversity
 - Mobility : simulable network representations extracted from DT layers
 - Risks: **Submersion, flooding, Urban Heat Islands ...**
- **Visualisation and interaction with digital twins**
 - Datasets : **complex + massive + dynamic + heterogeneous + uncertain**
 - Interactive visualisations on (**XR, Metaverse, web/Desktop, smartphone, screenwalls...**)
 - **Collaborative/multi-user** visualisations (symetric, assymetric, in/ex situ...)
 - Generation of **dynamic populations** to increase immersion (pedestrians, vehicles...)
 - **Realistic visualisation** : Communication, Virtual tourism and archeology, Simulation results...



- **A work package to prepare the commercial operation of the infrastructure and anticipate its economic balance**
 - From a construction model based on funding ...
 - ... to an operational economic model that must generate revenue.
- **Towards a "*platform as a service*" model**
 - Focused on Business-to-Government and Business-to-Business,
 - With revenue streams based on an infrastructure providing access to (secure) data (space) and advanced services and features (e.g., payment or subscription for API access, querying, computation, simulation model integration)
- **Two types of audiences (or "customers")**
 - Users seeking access to advanced services and features (e.g., public organisations, local authorities, sector-specific industries, consulting firms),
 - Services providers (e.g., startups or innovative companies) developing downstream services, solutions, or even sectoral or thematic digital twins.
- **Then, creation of a dedicated public-private entity for operational management ?**

DIGITAL TWIN OF FRANCE AND ITS TERRITORIES BRING HOME MESSAGES

- **A STARTING PROJECT** with a MVP foreseen in 2028
- **A FEDERATION OF ACTORS** (public & private) to develop a new industry around digital twins
- **A CALL FOR COMMONS** to identify needs, experience feedbacks and solutions' providers
- **A COMMON OPEN INFRASTRUCTURE** for data, services, applications at a national scale
- **TO SERVE PUBLIC POLICIES** with a concern of sharing knowledge, initiatives and costs



THANK YOU FOR YOUR ATTENTION