DIGITAL TWIN READY DATA AVAILABLE IN THE GREEN DEAL DATA SPACE

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a highly accurate digital replica of the Earth

Destination Earth is a flagship initiative of the European Commission to develop a highly accurate digital model of the Earth to monitor and simulate natural phenomena, hazards and the related human activities.

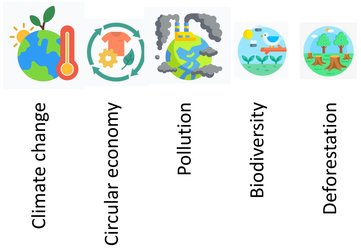
Funded by the European Union — Destination Earth — Implemented by ECMWF, esa, EUMETSAT

- **DestinE Platform**
- **Digital Twins and Digital Twin Engine**
  - Climate Change Adaptation Digital Twin (Climate Adaptation DT)
  - Weather-Induced Extremes Digital Twin (Extremes DT)
- **Destination Earth Data Lake**

DestinE will develop and deploy a service backbone composed of computer processing, data, software, and infrastructure.

The Green Deal Data Space will organize available data in services and APIs that provide high priority Digital Twin Ready Data to the DestinE data lake.

What is the Green Deal



The European Green Deal is a package of policy initiatives with the ultimate goal of reaching climate neutrality by 2050.

The European climate law
- Cutting net greenhouse gas emissions in the EU by at least 55% by 2030 (compared to 1990 levels)
- **mapping out the pace of emission reductions until 2050**
- **developing a system to monitor and report on the progress towards the goal.**

EU strategy on adaptation to climate change
- **better gathering and sharing of data to improve access to and exchange of knowledge on climate impacts**
- nature-based solutions to help build climate resilience and protect ecosystems.

EU biodiversity strategy for 2030
- extending protected land and sea areas in Europe
- restoring degraded ecosystems by reducing the use and harmfulness of pesticides
- **actions and better monitoring of progress.**

Farm to fork strategy
- ensure sufficient, affordable and nutritious food
- support sustainable food production
- promote sustainable food consumption and healthy diets.

European industrial strategy
* support the industry as accelerator and enabler of change
* promote sustainability, circularity and environmental protection.

Circular economy action plan
- designing sustainable products, circularity in production processes and empowering consumers and public buyers
- targets sectors such as electronics and ICT, batteries, packaging, plastics, textiles, construction and buildings, and food.

Clean, affordable and secure energy
- supporting cleaner energy sources: renewable offshore energy and hydrogen
- developing interconnected energy infrastructure via EU energy corridors.

EU chemicals strategy for sustainability
- better protect human health
- strengthen the industry's competitiveness
- support a toxic-free environment.

Forest strategy and deforestation
- promoting sustainable forest management
- adopt environmentally friendly practices
- improving the size and biodiversity of forests, including by planting 3 billion new trees by 2030.

More: https://www.consilium.europa.eu/en/policies/green-deal/

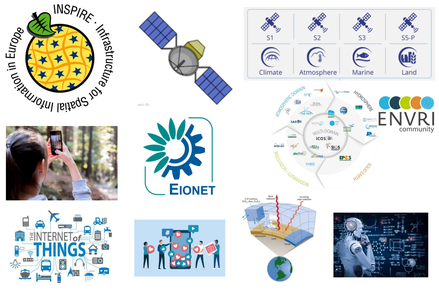
Data spaces

A Data Space is an infrastructure that enables data exchange between different participants based on the governance framework. Data Spaces enable:
- Trusted and secure trading of commercial data assets with automated and robust controls on legal compliance and remuneration.
- Compliance with regulations for personal data is ensured; data subjects and holders can control their data and its subsequent use.

Green Deal Data Space (GDDS)

The Green Deal Data Space will support implementing Green Deal policies with relevant data (e.g. on air, water, soil quality with regard to the zero-pollution strategy) and contribute to better environmental transparency and better decision-making.

Data sources for the GDDS

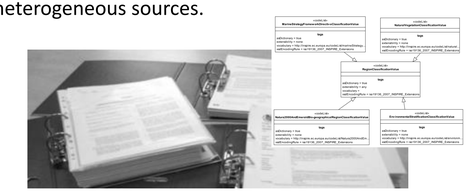


Special Issue on Data Spaces

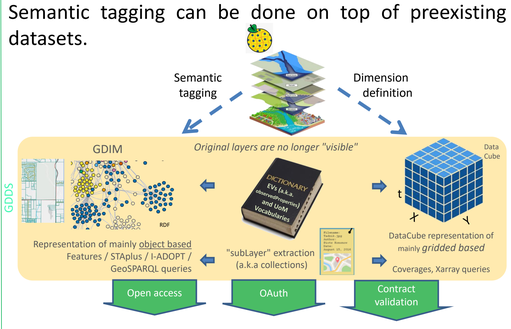
Challenges in the GREEN DEAL DATA SPACE

Enable semantic interoperability

The Spatial Data Infrastructures encoded meaning by agreeing on comprehensive and well documented data models that are exposed in *application schemas*. That is possible when new datasets are produced in a coordinate way (e.g. INSPIRE data models), but it is not possible if the data already exist from heterogeneous sources.

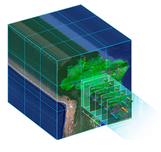


Instead, Data Spaces should be based on flexible data structures with properties semantically tagged. Semantic tagging can be done on top of preexisting datasets.



Dynamic multidimensional data cubes

The traditional representation of static two-dimensional layers needs to be replaced by a dynamic view where time becomes an extra dimension. In addition, other dimensions emerge such as the height in atmospheric and oceanic models, the frequency in hyperspectral remote sensing data or the species in a biodiversity distribution model. These dimensions define a data cube



OPEN DATA CUBE

rasdaman raster data management

Integrate OGC APIs implementations with data space connectors

The OGC web services paved the way to data sharing in the Spatial Data Infrastructures. The modern web (and the Data Space) is based on Web APIs. The OGC has reacted by releasing new OGC web API standards that allow for a good connection between geospatial and non-geospatial data on the web.

F — OGC API records, DCAT and STAC enable the discovery of geospatial and non-geospatial resources.

A — OGC API Features, OGC API Coverages and SensorThings API offer capacity to access data in subsets. The OGC API Maps and OGC API Tiles offer visualizations services for data.

I — OGC RAINBOW provides vocabularies that enable interoperability among geospatial data sources.

R — OGC API processes allow for reuse of data in analytical computations.

Sensor and IoT data

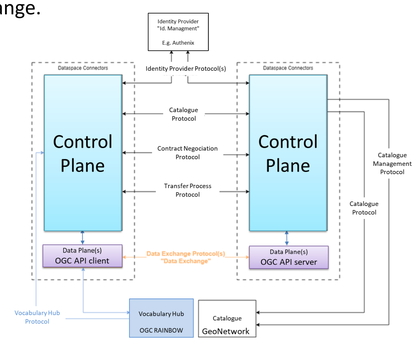
In-situ sensors are a continuous source of Earth observation data. An increasing number of low-cost sensors producing observations of a reasonable quality are being deployed in several fields.

Many of these sensors have wireless connections that enable them to automatically make available their data to central repositories that can then be part of a data space.

Commonly, sensors provide a time series of numerical observations of observable properties (e.g. environmental variables) which need to be characterized by the variable name and the units of measure associated. Both parameters should also be linked to the same external vocabularies.

Integrate private, sensitive, commercial data

To enable digital economy and to protect privacy we need to enable secure data exchange in an open web space. Data Spaces incorporate several security related technologies under the umbrella of connectors. Connectors bring trust to Data Spaces and allow data exchange under conditions stipulated in a digital contract between parties. OGC APIs need to be adapted to dialogue with connectors to support geospatial data exchange.



Data Queries

In the big data paradigm, access to individual layers is difficult due to the dynamic nature of the data. Instead, a set of modern APIs is needed as an entry point to the data in the data space.
OGC APIs offer a set of building blocks that can be combined together with other web API design principles to build the GDDS data access APIs.
Digital twins will be able to get the necessary data for modeling and simulating the reality using the OGC APIs endpoints.
OGC APIs include the concept of collections as an initial filtering mechanism but a filtering extension using CQL2 is in advanced draft status.
SensorThings API is an OGC standard that uses OData queries to retrieve observations. These observations are grouped into datastreams that include links to definitions of units of measure and observed properties.

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