Interoperability for Digital Twins

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BLB, OGC
OUTLINE

What is a digital twin of the ocean?

Federated interoperable systems - the Iliad approach

Thematic/local twins and citizen science

Interoperable cross-regional marketplace
Iliad’s Digital Twin of the Ocean provides a virtual environment representing the ocean, capable of running complex, predictive management scenarios. The innovative system integrates cross-discipline sensors, models and digital infrastructures.
The ocean is vast and complex. It consists of geophysical, biological and numerous interaction between its components and human activity. To reflect this complexity of European digital twin of the ocean, the EU, its members and associates are developing a core infrastructure, Modelling capacity and implementations in local and sector /thematic twins. This ecosystem of twins and its components are referred to as the European digital ocean twin. Iliad partnership being part of this dynamic ecosystem is working closely with other projects and initiatives (public & private) to ensure alignment by using similar standards, APIs, best practices etc. Iliad partnership is working towards the implementation of interoperable systems, services and assets.
Enabling an ecosystem of interoperable digital twins for the ocean trough:
- Connecting to existing ocean data infrastructures
- Enhance ocean data infrastructures with additional observation technologies and citizen science

Create an open marketplace accessible for all providers and users by:
- Development of innovative methods in open frameworks and platforms
- Enable model evaluations & comparisons for many Earth science applications from weather, energy, aquaculture to climate and more

Provide solutions to address future societal challenges by:
- Assembling a broad and diverse user community of existing and new users,
- Supporting the communities in testing and using the project’s innovative technological solutions
A federated interoperable system

Iliad architecture and technical solutions
Mechanics

Feed, clean, pre-process to ARD?, curate

Assess, compare, gate

Build & train

Configure, feed, run,

Verification

Derivates

ASSETS

Twin Data

DOMAINS

ICT

Models

Physical, ML

Simulations

Open Geospatial Consortium

Iliad
Designing Digital Twins of the Ocean

Designing an architecture to deliver digital twins of the ocean requires a multi-disciplinary approach that integrates data science, engineering, and computer science.
Reusability in action

Time, sensor, resolution

Where

Process $f$(inputs, time, space) (+ state)

Related models and processing

Derived Data

Related models and processing

Credits https://doi.org/10.3389/fmars.2021.633128
OGC Best Practice

- OGC 20-089 defines guidance for:
  - A Developer to adapt an application
  - An Integrator to package an application
  - An Platform to deploy and execute the application
- 12 submitters organisations
Overview of the layers of the first release of the ILIAD Ocean Information Model (OIM)
Thematic/local twins and
citizen science
ILIAD DIGITAL TWINs OF THE OCEAN

Existing Wind Farm Capacity
Ocean Energy Potential
Coastal Sediment Transport
Plastic Pollution Monitoring
Oils Spill Simulation
Insurance For Marine & Maritime Activities

Jellyfish Swarm Forecast
Harbour Safety
Met Ocean Hind, Now & Forecast
Fisheries Productivity & Sustainable Aquaculture
Ballast Water Monitoring
Aquaculture & Harmful Algae, Water Quality & Ship Traffic

ocean-twin.eu
/oceantwin
@ocean_twin
DIGITAL TWINS OF THE OCEAN
Interoperability across regions

Marketplace
New sensors, Observatories

Iliad

Iliad Market Place

Semantic harmonization on APIs

Front-ends

Visualization

Actions/Control

Access point - Marketplace

Digital Twin

Data Acquisition/Collection

Digital Twin

Representation

Digital Twin

Hybrid (Cognitive) Analytics Models

Digital Twin

Visualization and Control

Iliad

Piotr Zaborowski et al, 2022
ILIAD is part of a vibrant ever evolving ecosystem of digital twins, including its great variety of resources ranging from data providers, cloud services, ocean modeling, biodiversity, data spaces all organized by a plethora of institutions and projects in Europe and beyond.
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