BioDT

Introduction and Objectives

BioDT Project Management Office

Funded by
the European Union

- **Project name:** Biodiversity Digital Twin for Advanced Modelling, Simulation and Prediction Capabilities (BioDT)
- **Call title:** Next generation of scientific instrumentation, tools and methods (HORIZON-INFRA-2021-TECH-01)
- **Duration:** 1 June 2022 – 31 May 2025 (36 months)
- **Consortium:** 22 partners
  - Experts in biodiversity, high-performance computing, artificial intelligence, digital twinning and FAIR data
  - Partners from 12 countries: Finland (FI), Italy (IT), Czech Republic (CZ), the Netherlands (NL), Estonia (EE), Sweden (SE), United Kingdom (UK), Germany (DE), Austria (AT), Denmark (DK), Norway (NO), Spain (ES)
    - Incl. one Affiliated Entity and three Associated Partners
- **Work Package (WP) members:** 140+
- **Coordinator:** CSC – IT Center for Science
- **Website:** www.biodt.eu

Partners

CSC

Trust-IT Services communicating to markets

ECMWF EUROPEAN CENTRE FOR MEDIUM RANGE WEATHER FORECASTS

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Swansea University
Prifysgol Abertawe

COMMpla

UK Centre for Ecology & Hydrology

UNIVERSITAS OSLOENSIS MDCCCXI
UNIVERSITY OF OSLO

MANCHESTER 1824
The University of Manchester

Naturalis Biodiversity Center

SENCKENBERG
world of biodiversity

TNO innovation for life

JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ

IT4I

GBIF

UFZ HELMHOLTZ Zentrum für Umweltforschung

BAYER

KTH VETENSKAP OCH KONST

1632 UNIVERSITY OF TARTU

LifeWatch ERIC

umweltbundesamt
ENVIRONMENT AGENCY AUSTRIA

MARTIN-LUTHER-UNIVERSITÄT
HALLE-WITTENBERG

BioDT Objectives

- OBJECTIVE 1:
  - Build and deploy a pre-operational BioDT for addressing biodiversity dynamics
- OBJECTIVE 2:
  - Support the interoperability of data and services through the integration of the BioDT with research infrastructure platforms and workflows
- OBJECTIVE 3:
  - Ensure interoperability of BioDT with Destination Earth and the European Data Infrastructure

1: Pre-operational BioDT platform

- Platform established on LUMI
- Case studies for model development
- Model development[1] and validation
- Serving user needs beyond the project consortium

Outcome	Description
1	Prototype available as service
2	Several case studies
3	Improved model predictive performance
4	Increased model accuracy and precision

[1] Incl. upscaling for HPC, features for interactive use

2: Integration with RIs

- Application programming interfaces (APIs), user authentication and access
- Interoperability: data, software, practices
- Uptake by research communities, new user communities, training

Outcome	Description
1	APIs for feeding data to BioDT platform
2	FAIR datasets using cross-RI standards and FDOs
3	Quality indicators, e.g. FAIRness assessment metrics, geographic accuracy
4	Training materials and interoperability workshops
5	Improved modelling, simulation and predicition capabilities for RIs

3: Interoperability with DT initiatives (incl. DestinE) and EDI

- Cross-DT synchronisation and showcases
- EOSC data integration, openly available results
- Showcases for interaction between the BioDT and other DTs
- Harmonised data and data governance (EU Data Spaces)

Outcome	Description
1	BioDT data outputs to DestinE data lakes
2	Interfaces and data integration for interaction with EOSC
3	Integration of DestinE output data for use by BioDT
4	Synchronisation with other DT initiatives (e.g. Ocean DT)

The BioDT prototype Digital Twins (pDTs) are divided into four main groups focusing on:

Species response to environmental change

- Biodiversity dynamics
- Ecosystem services

Genetically detected biodiversity

- Crop wild relatives and genetic resources for food security
- DNA detected biodiversity, poorly known habitats

Dynamics and threats from and for species of policy concern

- Invasive species

Species interactions with each other and with humans

- Disease outbreaks
- Pollinators

Data from four RIs

GBIF, eLTER, LifeWatch ERIC and DISSCo

GBIF

The Global Biodiversity Information Facility (GBIF) is an international network and data infrastructure providing open access to biodiversity data.

LifeWatch ERIC

LifeWatch ERIC is the e-Science European infrastructure for biodiversity & ecosystem research.

eLTER

The Integrated European Long-Term Ecosystem (eLTER) focuses on critical zone and socio-ecological research.

Helmholtz Center for Environmental Research (UFZ), UK Centre of Ecology & Hydrology (UKCEH), Environment Agency Austria (EAA) and University of Helsinki (UH)

DiSSCo

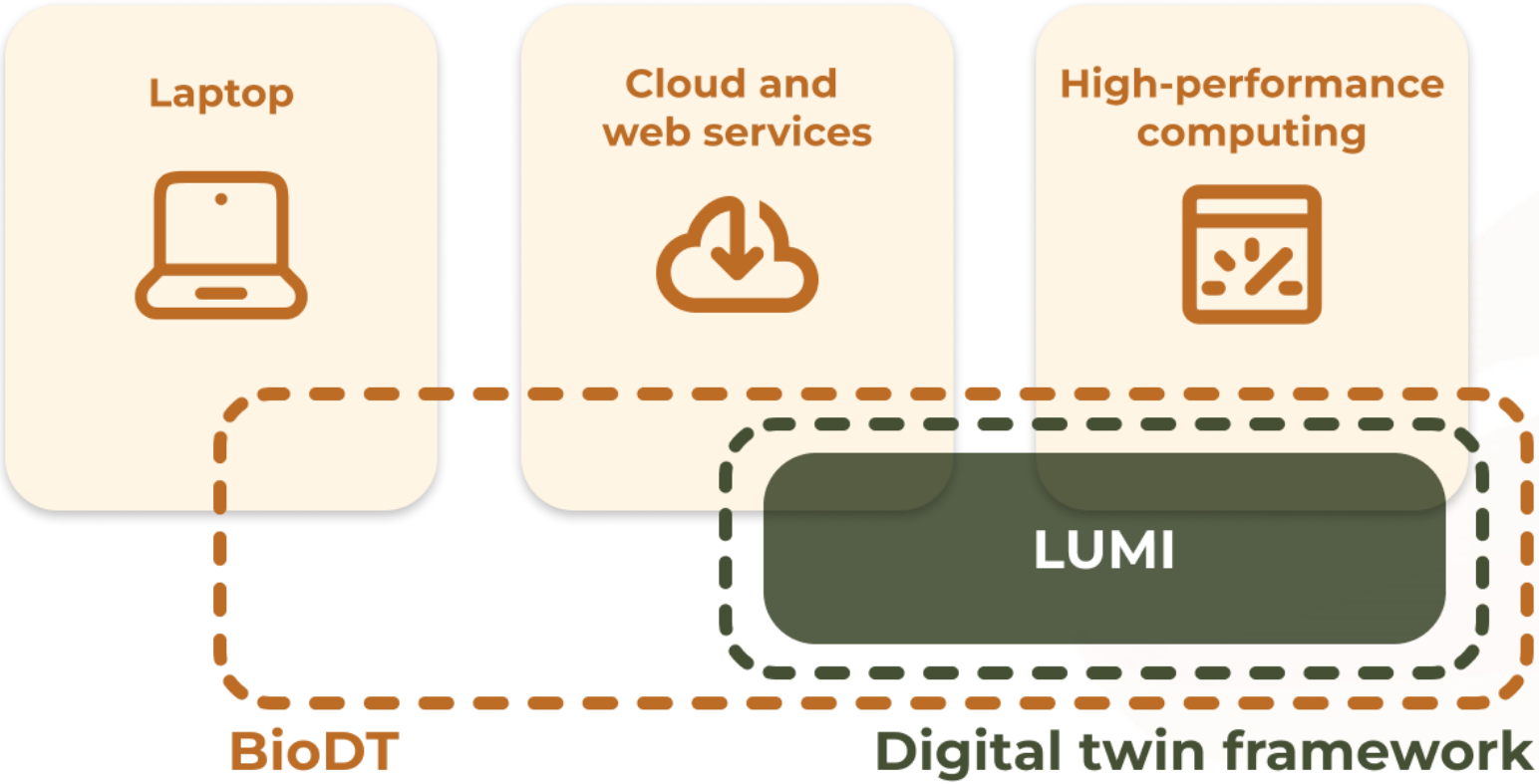
The Distributed System of Scientific Collections (DiSSCo) is a Research Infrastructure (RI) for Natural Science Collections.

Naturalis Biodiversity Center (Naturalis) and Senckenberg Society for Nature Research (SGN)

LUMI Supercomputer

- Leveraging high-performance computing, AI and data analytics capabilities of the LUMI supercomputer
- LUMI is the 3rd fastest supercomputer in the world
  - Sustained performance: 375 petaflop/s = performs 375 x 10^{15} calculations per second
  - Computing power equals to the capacity of 1.5 million modern laptops

- Digital twins require platforms for **computational simulation**
  - Detailed and realistic simulations require large amounts of computing time



Digital Twin Advanced Technical Platform

- HPC resources from the LUMI EuroHPC computing facility
- Ensuring portability of digital twins across HPC sites and cloud environments
- Maintaining service catalogue of shared services for integration with EOSC Core services

BioDT Target Groups

Biodiversity RIs, RI nodes, data providers and researchers

RIs, universities, research organisations; the end-users that will contribute to developing the DT, enhancing its use cases, and testing its functionalities

Policy makers

EU, Member States, local governments, intergovernmental organisations (UNESCO, FAO, etc.)

Industrial actors incl. SMEs

Sectors related to biodiversity, such as agri-food, tourism, healthcare

Civil society and citizen scientists

Benefits

Researchers will be able to:

- Better observe changes in biodiversity in response to forces resulting from climate change or human activity
- Mechanistically understand how these changes occur
- Predict the effects of these changes

Biodiversity RIs will be able to:

- Improve their services

Policy makers will be able to:

- Make decisions based on quality data and modelling
- Better respond to societal needs and key initiatives

Industrial actors incl. SMEs will be able to:

- Exploit BioDT for business solutions (applications/products) in sectors related to biodiversity, such as agri-food, tourism and healthcare

Citizen scientists and civil society:

- Boost citizen science
- Strengthen common understanding of biodiversity dynamics and prediction models
- Foster biodiversity literacy and trust in biodiversity research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