BIODT
biodiversitydigitaltwin

Introduction and objectives

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biodt.github.io/slides/webinars/harrison-130722.html

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1. **Background**
   DT concept in BioDT

2. **Objectives**
   Project goals and outcomes

3. **BioDT Use Cases**
   Practical applications

Virtual representation(s) of real-world entities and processes, synchronised at a specified frequency and fidelity

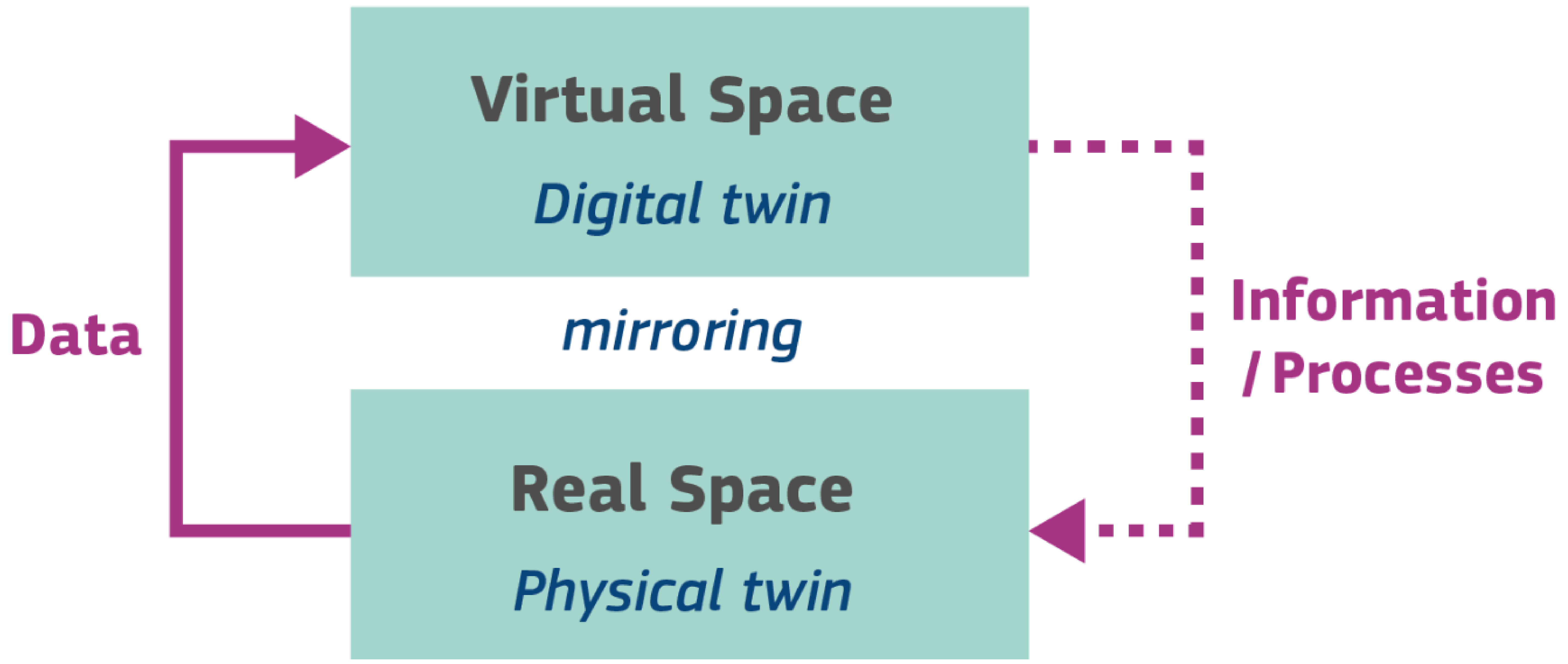


Image: digital-strategy.ec.europa.eu

- **Industrial** DTs typically facilitate:
  - Product design
  - Operation of machinery

- In **BioDT**, DTs used to:
  - Mimic behaviour observed in nature
  - Meet requirements of BioDT Use Cases
  - Contribute toward EC goal of devising a full DT of the Earth

Objective 1

Build and deploy pre-operational BioDT platform

Objective 2

Integration with RI platforms and workflows

Objective 3

Interoperability with European DT initiatives (including DestinE) and European Data Infrastructure

1: Pre-operational BioDT platform

- Platform established on LUMI
- Case studies for model development
- Model development[1] and validation

Outcome	Description
1	Prototype available *as service*
2	Eight 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

- APIs, user authentication and access
- Interoperability: data, software, practices
- Uptake, new user communities, training[1]

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, geographic accuracy
4	Training materials and interoperability workshops

[1] e.g. *Bring Your Own Data* hackathons

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

- Cross-DT synchronisation and showcases
- EOSC data integration, openly available results
- Harmonised data and data governance (EU Data Spaces)

Outcome	Description
1	BioDT data outputs to DestinE
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)

Use Cases split into four groups

8 USE CASES

Group1	Group2	Group3	Group4
Species response to environmental change	**Genetically detected biodiversity**	**Dynamics of species of policy concern**	**Influence of species interactions on planetary well-being**
Biodiversity dynamics	Crop wild relatives, genetic resources for food security	Invasive species	Disease outbreaks
Ecosystem services	DNA detected biodiversity, poorly known habitats, soil	Endangered species	Pollinators

Data from four RIs:

DISSCo, eLTER, GBIF, LifeWatch

Current status:

Existing modelling approaches insufficient

Approaches:

Hybrid modelling approaches

Combining biotic and abiotic data

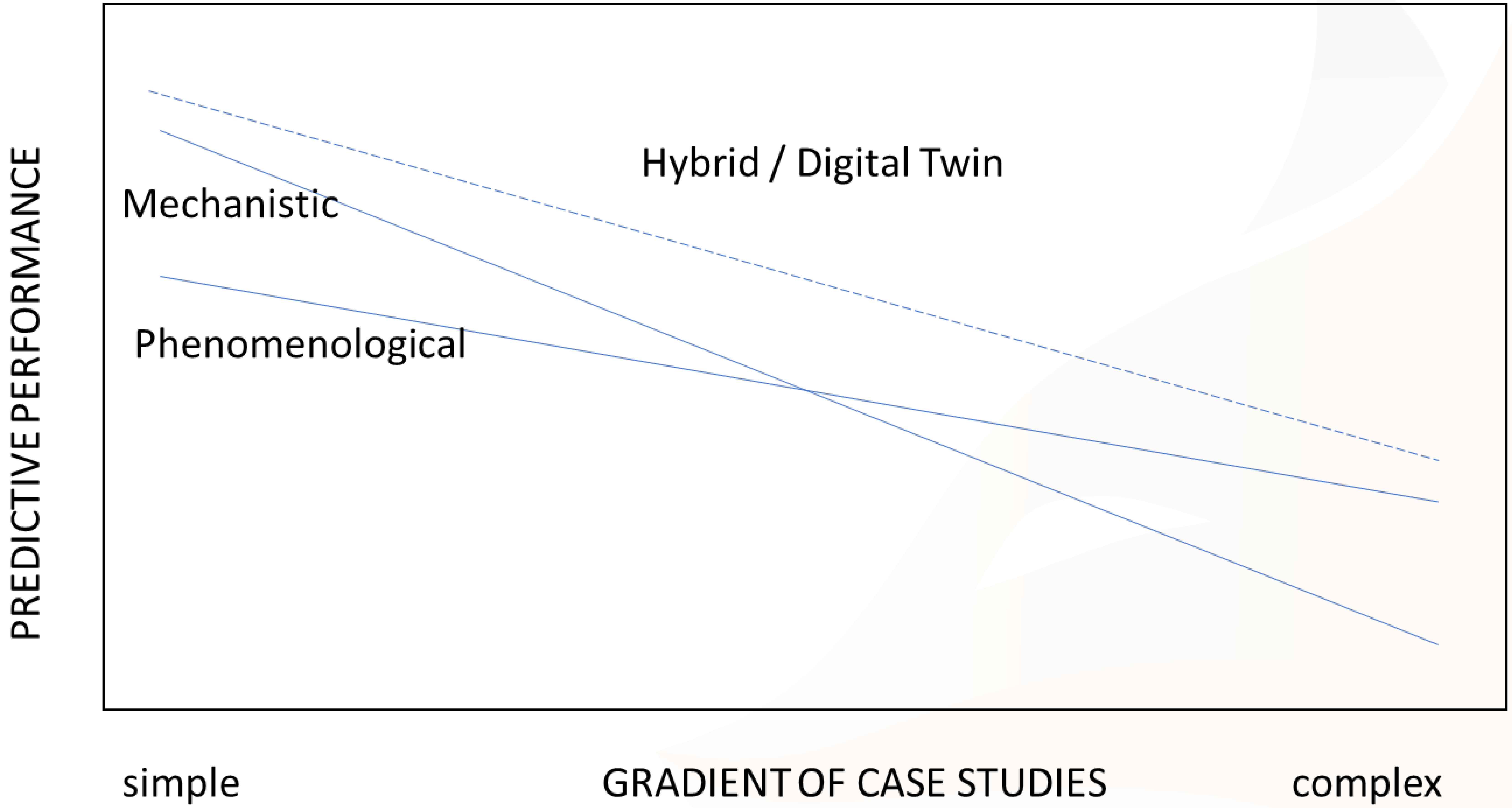
HPC-compatible modelling tools

Anticipated benefits:

Improved predictions of shifts in diversity, distribution and abundance

Ability to quantify uncertainty

Tools enabling computationally demanding modelling


PREDICTIVE PERFORMANCE
Hybrid / Digital Twin
Mechanistic
Phenomenological
simple
GRADIENT OF CASE STUDIES
complex

Current status:

DNA-based methods increasingly needed (e.g. food security)

Approaches:

Models involving e.g. crop wild relatives, cryptic habitats

Incorporating DNA-based methods in DTs (e.g. for taxon IDs)

Addressing challenges specific to genetic data

Anticipated benefits:

Improved understanding of biodiversity in arable lands and soil

Applied uses (e.g. DNA-based biodiversity monitoring by SMEs)

Current status:

- No reliable modelling approaches for invasive or endangered species
- Challenges: e.g. data scarcity, lag effects

Approaches:

- Exploiting large-scale spatial and high-resolution temporal data
- New generation of predictions for invasive and endangered species

Anticipated benefits:

- Improved tools to aid evidence-based ecosystem management

Current status:

Multiple pressures coinciding with climate change (e.g. pandemics, pollinator loss)

Approaches:

Predicting outbreaks using e.g. pathogen distribution data

Modelling pollinator distribution and types

Maps of forage availability in agricultural landscapes

Anticipated benefits:

Information on emerging diseases and their locations

Improved knowledge of pollinator responses to environmental change

BioDT will provide infrastructure to:

- Drive long-term biodiversity research
- Maintain commitments to protect biodiversity
- Safeguard societal resilience

BioDT will be used to:

- Better observe spatiotemporal changes in biodiversity
- Develop an improved mechanistic understanding of these changes
- Push limits of predictive biodiversity modelling

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