

# TNO Primer on Collaborative Digital Twinning

## TheEASY3s

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Digital Twin is not a monolithic software package. It has many integral parts that together should be continuously managed efficiently to be effective and safe, especially when you collaborate with partners across companies.

## What 's inside

Following the rule of threes.

In this TheEASY3s concise getting started guide, you will find



### **Key considerations**

for successful Collaborative Digital Twinning (CDT) with effective Data Sharing.



### **A cheat sheet**

with key definitions to equip you to start exploring three why's, how's, and what's of CDT to kickstart your journey



### **Quick reference schematic**

inspired by pilot projects to engage with like-minded peers eager on the journey

# At a glance

## Unlock the power of Collaborative Digital Twinning (CDT), streamlining your Digital Twin Applications for enhanced value in complex systems value chains.

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Collaboration is crucial, especially where stakeholders must unite for seamless CDT in Data Sharing ecosystems consisting of multiple organisations. However, digital twins can be immature, incomplete, unsafe, or uncertain. The System of Systems that must keep them running can bring significant value, but this requires careful handling.

Provisioned, smooth and uninterrupted CDT ensures optimal impact. It can serve existing purposes more effectively and can uncover new, previously infeasible goals.

Neglecting collaborative efforts can disrupt operations, business processes, and even jeopardise the entire existing ICT infrastructure. Emphasise the importance of effective Data Sharing and collaboration in your organisation for the greatest possible value by bolstering your CDT journey.

Read further to learn more about co-governance, model and workflow management, and data sharing and shared computing considerations for you to get started or improve your collaboration.

## Cheat sheet



### **Digital Twin (concept)**

Modern digital approach of combining models, data, and technologies with goal-oriented operations.



### **Digital twin (object)**

Digital copy or simulation model of a real-world thing that stays updated in real-time.



### **Digital Twin Application (solution)**

Purpose-specific practical tool that combines twins with information, technologies and digital systems.



### **Digital Twinning (activity)**

Managing the entire life of a Digital Twin Application and its parts, from creation to making it work.



### **Digital Twin lifecycle technology (solution)**

Technology that helps with the whole life of the Digital Twin Application and its digital copies.



### **Real-world or physical twin (object)**

Real entity or process for which data and information is shared in (near) real-time.



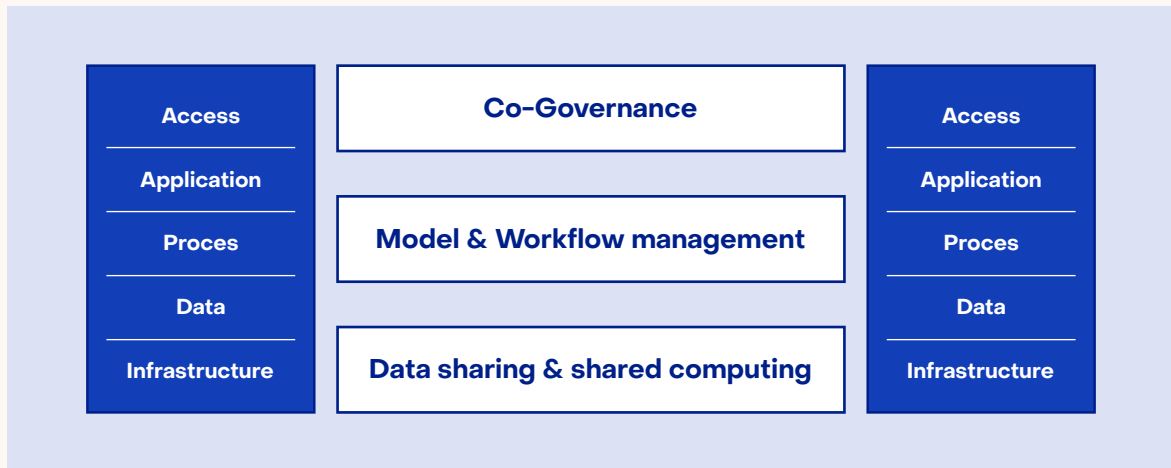
# CDT Quick Reference Schematic

This is a quick reference for Collaborative Digital Twinning.

As multiple organisations each engage in Digital Twinning, they utilise different tools and technologies covering key aspects that are simplified here and categorised as Digital Twin Infrastructure, Data, Process, Application, and Access. For effective collaboration between multiple organisations, it is then crucial to consider overarching elements across these Digital Twin aspects.

We emphasise Co-governance, Model & Workflow Management, and Data Sharing & Shared Computing as essential topics in this context.

Enhance your co-governance with metadata technology to promote smooth collaboration during continuous alignment and engagement activities.



Enrich your data sharing and shared computing with offloader technology to promote provisioned collaboration for robust and scalable pooled computing resources during engagement activities.

Augment your model and workflow management with ECiDA technology to promote uninterrupted collaboration when executing changes to models and workflows during engagement activities.

# Quick look

TNO actively participates in various global projects, tackling diverse facets of society. Each of these projects exemplifies a multidisciplinary strategy to address real-world challenges, leveraging the advantages of Digital Twinning. These include numerous pilot cases that engage in CDT with Data Sharing, serving as tangible references for potential collaboration partners to learn from each other.



## Earth and Life Science

### BioDT

BioDT is on a mission to safeguard and restore biodiversity through Digital Twinning. They create Prototype Digital Twin pilot cases that delve into various global biodiversity aspects such as dynamics, pollinators, ecosystem services, disease outbreaks, and invasive species. A technical platform backs these cases, allowing the use of the LUMI high-performance computer for advanced simulations, promoting FAIR data sharing, and employing AI-driven solutions.

<https://biodt.eu/>



## Energy

### Enershare

Enershare is all about making energy systems more independent and ensuring they exchange data in a trustworthy way. It is all about sharing and upgrading current energy systems to make them smarter and stronger. The project uses a data-driven blueprint for the energy domain and hosts a marketplace using blockchain and smart contracts to boost trust among collaborators.

<https://enershare.eu/>



## Transport and Mobility

### ZEFES

ZEFES seeks to enhance the long-haul freight ecosystem, aiming for cost-effectiveness, reliability, energy-efficiency, extended range per charge, and reduced charging times. Employing digital twinning for improved logistics planning and energy management, the various Digital Twin Applications must collaborate to achieve a globally optimal outcome. They thus develop tools for fleet managers to improve logistics planning and offer valuable insights into predictive maintenance, eco-driving, and charging infrastructure. In this partnership, collaborators must operate seamlessly in and across international borders.

<https://www.2zeroemission.eu/research-project/zefes/>

# Why

## Retention



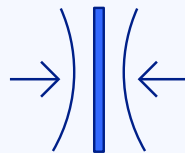
Connect smartly to enhance your data and knowledge-sharing practices. Combine resources and exchange data and knowledge to learn from one another. This way, you will retain more knowledge, promoting sustainable business continuity, innovation, service quality, your competitive edge, and ultimately, boosting employee morale.

## Reliability



Work together with assurance to establish trust by carefully preparing and monitoring your actions and plans. Enhance trust and confidence in your collaboration by organising and streamlining communication. This contributes to more reliable insights and results, supporting informed decision-making, risk mitigation, customer trust, and continuous improvement.

## Resilience



Navigate your decisions more effectively for secure outcomes by improving your risk control. Organise your collaboration for a clearer understanding of activities, revealing weaknesses and strengths. This brings heightened resilience in a future full of surprises, where adaptability, sustainability, innovation, and risk management collectively simplify the identification and seizing of new opportunities.

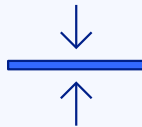
# How

## Know



Understanding your collaborator is vital for knowing shared interests and individual dislikes. Using the 7-STEPS development guide for creating your Digital Twin Application, akin to many other methodologies, starts with clarifying goals. Using COMPASS assessment technology can help you collect shared perspectives and interests from diverse collaborators, culminating in a final dashboard that can show the common direction aligned with your shared interests.

## Align



Ensuring a strong relationship is essential to guarantee operational readiness and retain control over the resilience and security of your business continuity. When choosing assets, it is critical to discern what to expose and what to protect. Technological considerations are crucial due to the dependencies created. Using the Technology Readiness assessment helps you and your collaborators identify areas still and not needing more attention. It pinpoints where sufficient measures are already in place, preventing unnecessary financial strain and delays.

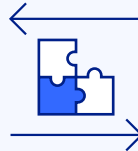
## Engage



Working with your collaborator in the execution of shared business processes is vital for a sustainable collaboration. Using development guides and interactive assessment tools encourages active engagement with best practices. It is crucial to revisit them for ongoing alignment with business, people, and the digital technologies involved. These tools also help maintain an open communication channel. As business evolves, effectively, efficiently and safely managing the dynamic Digital Twin Applications, their twins, and Data Sharing technologies demands sound governance practices and technologies.

# What

## Provisioned collaboration



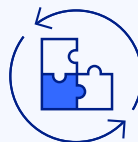
To promote seamless access to essential computing resources, you will need to easily scale your private and public computing services with Data Sharing technologies. Offloader technology automates hyperscale computing deployment and management, allowing for measured control to distribute data and computing workloads better. Invest time in configuration to optimally manage your pooled resources and reinforce redundancy in managing the inevitable co-dependencies.

## Smooth collaboration



To ensure seamless collaboration and secure information management within you and your collaborator's digital estate, you will need to leverage governance-supporting tools. Metadata technology helps to simplify labelling, sharing, communication, and exploration of data, models, and workflows across aspects of your Digital Twinning activities. Take this necessary step towards enhancing data discoverability, promoting efficient collaboration, reducing the likelihood of errors, and eliminating ambiguity.

## Uninterrupted collaboration



To maintain a harmonious flow of simultaneous live operational systems with likely interdependence, managing potential bottlenecks and failure events is crucial to prevent significant disruptions in business operations. ECiDA technology helps effectively handle adaptive workflows and compute pipelining integration that enables dynamic changes to live operational systems. Streamline your simulations seamlessly with collaborators, and if they do so too, experience no interruptions.

## Reach out

This concise guide merely scratches the surface of TNO's expertise in Digital Twinning. It serves as a primer for those embarking on or gearing up for advanced digitalisation, underscoring a myriad possibilities already available for your organisation and its collaborators.



Connect with us or explore the projects we showcase. When you reach out, rest assured that we can offer assistance or guide you to someone who can.



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