



interTwin

interTwin and EOSC

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EOSC Symposium 2023 - 21st Sept 2023



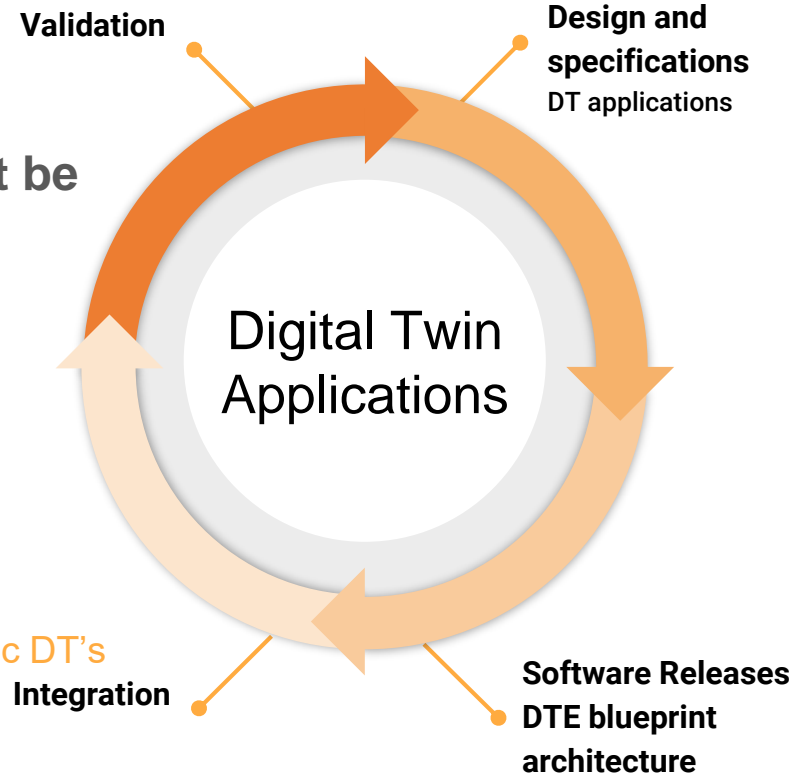
interTwin is funded by Horizon Europe under grant agreement n° 101058386



High level objectives

Creation of a **prototype digital twin engine**:

- Resulting **DTE Blueprint Architecture** must be
 - Interdisciplinary
 - Co-Designed (Providers and Communities)
- Resulting **Platform** must be
 - Open Source with
 - TRL 7 (prototype pilot)
- And it must be based on
 - **Open Standards**
 - with the capability to integrate with **application specific DT's**





Consortium Overview



EGI Foundation as coordinator

29

Participants, including 1 affiliated entity and 2 associated partners

Consortium at a glance

10
Providers

cloud, HTC , HPC
resources and
access to
Quantum systems

11
Technology
providers

delivering the
DTE infrastructure
and horizontal
capabilities

14
Community
representants

from 5 scientific
areas;
requirements and
developing DT
applications and
thematic modules

1.09.22 - 31.08.25

Budget 11,7 M euro

1

Co-design, develop and provide a Digital Twin Engine that simplifies & accelerates the development of complex application-specific DTs that benefits researchers, business and civil society

2

Co-design a Digital Twin Engine blueprint architecture that provides a conceptual framework for the development of DTs supporting interoperability, performance, portability & accuracy.

3

Extend the technical capabilities of the European Open Science Cloud with modelling & simulation tools integrated with its compute platform

4

Ensure trust and reproducibility in science through quality, reliability and verifiability of the outputs of Digital Twins

5

Demonstrate data fusion with complex modelling & prediction technologies

6

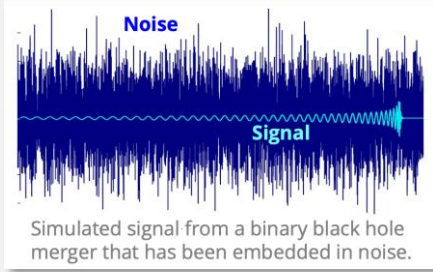
Simplify DT application development with tools to manage AI workflows and the model lifecycle while reinforcing open science practices





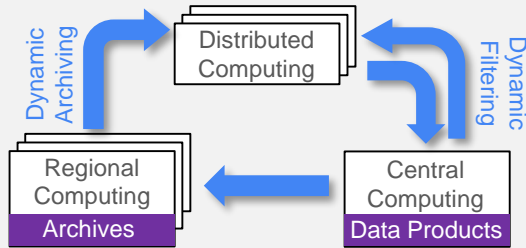
DTs of Radio astronomy and GW astrophysics

DT of the VIRGO Interferometer



It is meant to **realistically simulate** the noise in the detector, in order to study how it reacts to external disturbances and, in the perspective of the **Einstein Telescope**, to be able to detect noise “glitches” in **quasi-real time**, which is currently not possible. This will allow sending out **more reliable triggers** to observatories for multi-messenger astronomy.

DT for noise simulation of next-generation radio telescopes

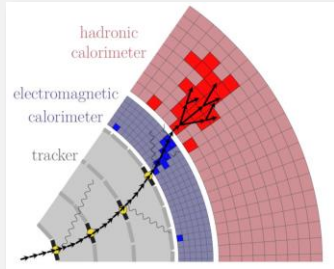


Meant to provide DTs to simulate the noise background of radio telescopes (**MeerKat**) will support the identification of rare astrophysical signals in (near-)real time. The result will contribute to a realisation of "**dynamic filtering**" (i.e. steering the control system of telescopes in real-time).



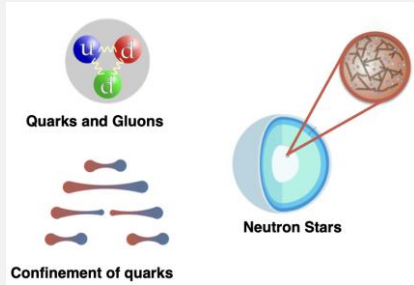
DT in High Energy Physics

DT of Large Hadron Collider (LHC) detector components



Seeking for strategies to face the increase in the need for simulated data expected during the future High Luminosity LHC runs. The primary goal is to provide a fast simulation solution to complement the Monte Carlo approach. ***Faster and deeper cycles of optimisation of the experiment parameters*** in turn will enable breakthroughs in experimental design.

DT of the Standard Model in particle physics



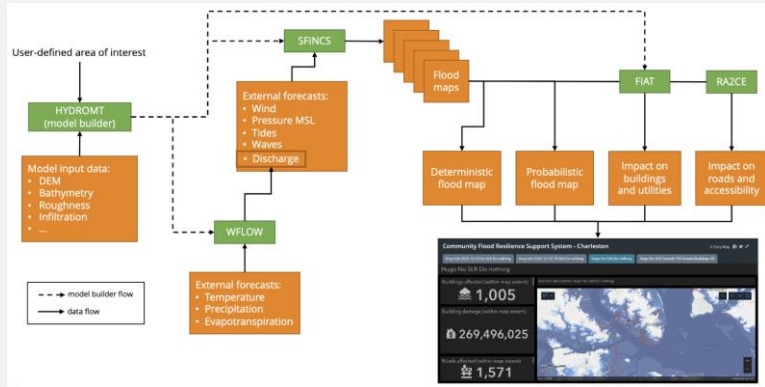
Competitive results in Lattice QCD require the ***efficient handling of Petabytes of data***, therefore the implementation of advanced data management tools is mandatory. On the side of algorithmic advancement, ML algorithms have recently started to be applied in Lattice QCD. The goal is to ***systematize the inclusion of ML for large scale parallel simulations***.



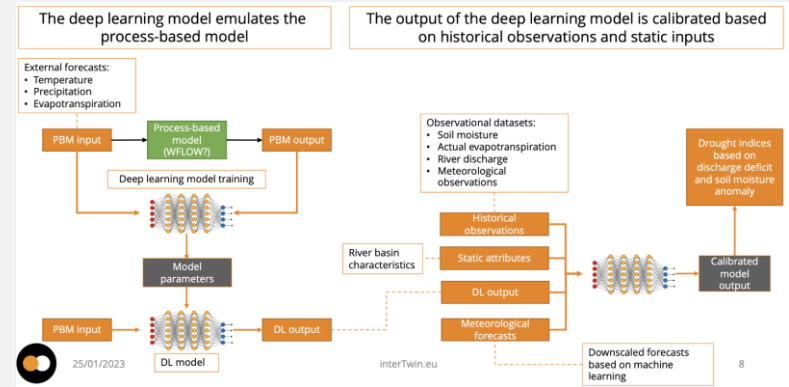
Three use cases on Extreme Events on Earth

DT for Extreme Events on the Earth

- Climate Change Future Projections of Extreme Events as **storms and fire**;
- Early Warning for Extreme Events of **floods and droughts**;
- Climate Change Impacts of Extreme Events of **storms, fire, floods and droughts**.



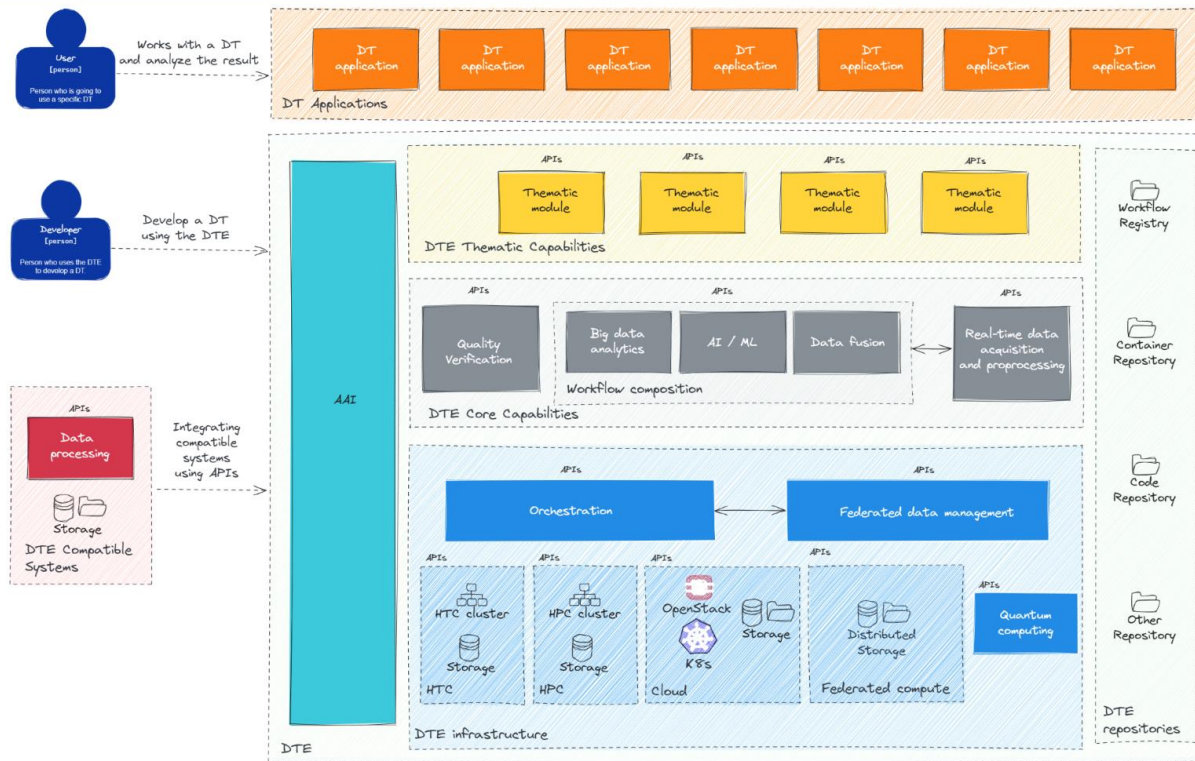
Digital Twin for Flood Early Warning in coastal and inland regions



Digital Twin for Drought Early Warning in alpine regions



interTwin components





interTwin and EOSC: EOSC Exchange



- The interTwin DTE core and infrastructure modules will reach at the end of the project the maturity to be included as an **EOSC service in marketplace** (min TRL 7)
- The EGI Foundation and project partners are committed to include the DTE or at least the following services as part of the EOSC Exchange as horizontal services
 - **DT Quality Verification** which is an extension of the SQAaaS service developed by *CSIC*
 - **AI/ML workflow** service developed by *CERN/Julich*
- Pilot DT Applications with higher maturity will also be registered and make available as Research Products





interTwin and EOSC: Interoperability Framework(IF)



- The DTE is adhering to some of the [guidelines](#) which are available or are candidate to join the **EOSC Interoperability framework**.
- The aim is to be compatible as much as possible with EOSC Core
 - EGI Check-in service is compatible with the AARC Blueprint which is at the base of the **EOSC Core AAI interoperability guidelines**
 - EGI Data Transfer service (part of the interTwin Data Lake) follows the **EOSC Data Transfer guidelines**
 - The project is extending the current **Accounting guidelines** to include also HPC and Kubernetes accounting which will be one of our contribution to the IF

interTwin and EOSC: EOSC Compute and FAIR Data



- The interTwin infrastructure is partly relying on the **EOSC Computing Platform** components implemented by the EGI-ACE project and providers from the EGI Federation
- The [EOSC Security Operational baselines](#) will also be adopted by interTwin providers not belonging to the EGI Federation (Part of the EOSC Exchange inclusion criteria)
- Discovery and access to **FAIR Data sources** registered in EOSC as input for Modeling and Simulations
- The interTwin DTs pipelines include quality verification via SQAaaS triggering also the [FAIR Evaluator](#), for the assessment and improvements of the source data repositories and output data for reuse.

Thank you!



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