

The Open Digital Twin Platform (ODTP)

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1 Digital Twin Model

We use a five-component Digital Twin model [1] for ODTP to capture quantities of interest from reality and represent higher order processes such as mobility in Switzerland.

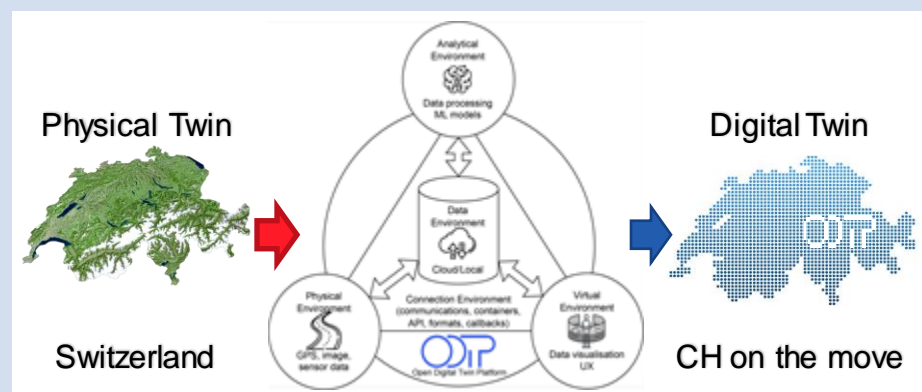


Figure 1: The physical twin (PT) is represented as a digital twin (DT) through the 5-component model [1]. The Physical environment captures quantities of interest, the data environment represents them, the analytical environment produces new insights and the virtual environments presents the outcomes to a user. The connection environment joins everything together and is provided by ODTP [2].

4 Digital Twin Implementation

ODTP relies on the cloud-based automation [4] with micro-services to provide the five environments for the digital twin model.

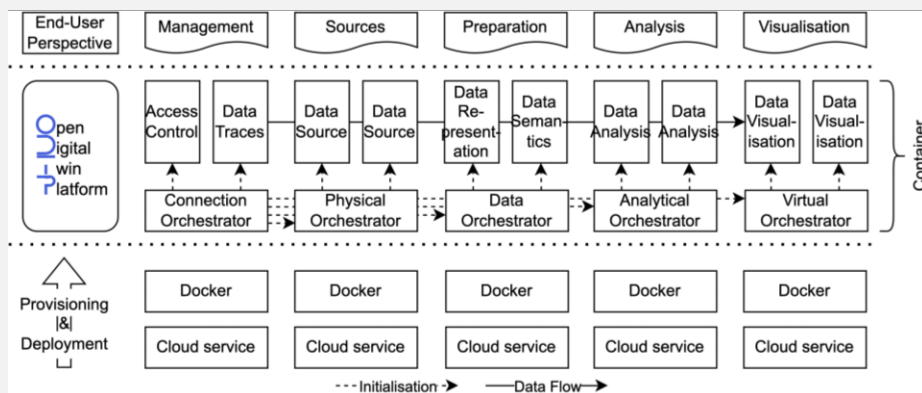


Figure 4. Micro-services for digital twin tasks are provisioned and deployed via docker in a cloud environment. ODTP runs common services for all twins and loads specific micro-services for individual twins. The end user performs different operations on the data from managing, to sourcing, preparing, analysing and presenting.

2 Digital Twin System Perspective

How systems interact within ODTP

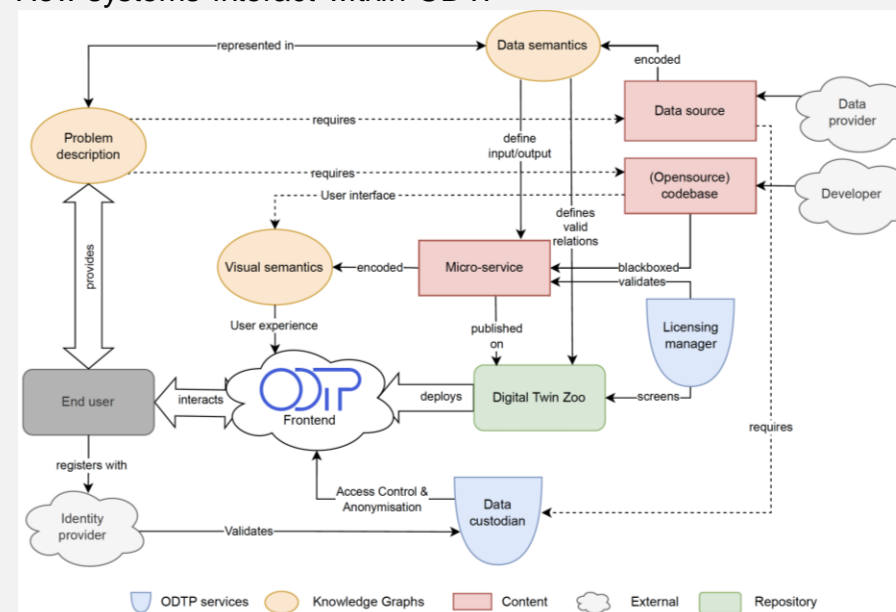


Figure 2. Systems overview [3]. End-users pose a problem to ODTP and receive a digital twin using micro-services that can answer the problem. The Digital Twin Zoo stores all known ODTP components for reuse. Access-control is provided by the data custodian and licensing is also managed.

5 Digital Twin Prototype

The first prototype “CH on the move” [2] of the Swiss Mobility System uses MATSim [5], Eqasim [6] and EasySynth [7] to provide mobility simulations.

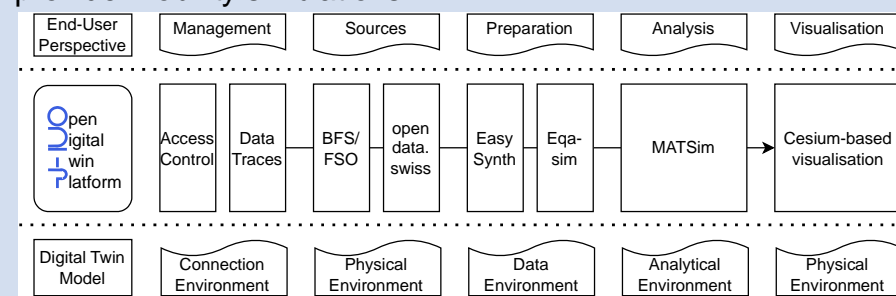


Figure 5. The “CH on the move” prototype implementing a mobility simulation of Switzerland.

3 Digital Twin Representation

Digital Twins are represented in ODTP with Traces. A Trace describes how data moves through a digital twin from the data source to the last service providing output for users. Traces allow for the reproduction of a digital twin.

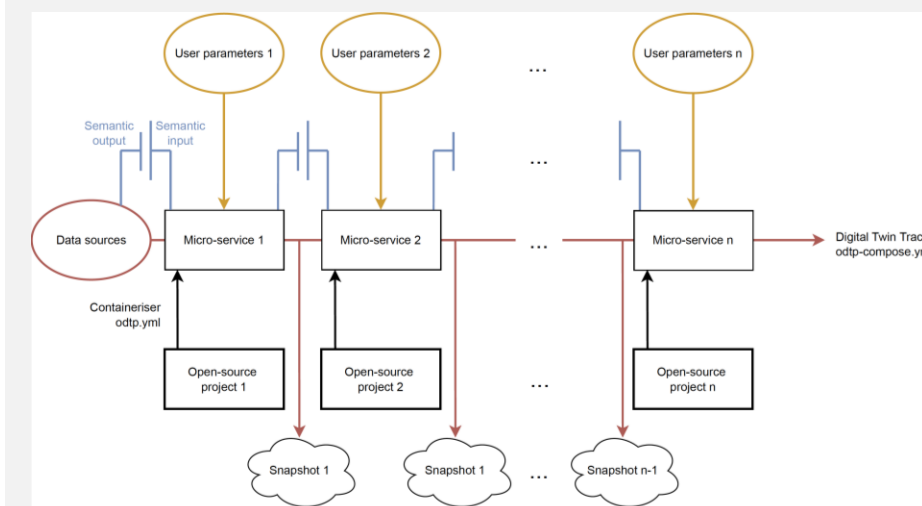


Figure 3. Data Traces provide a linearized representation of actions on the data (red arrow) including snapshots after each action. Actions are derived from open-source project that are containerized into microservices and provided with user-defined parameters. ODTP validates the semantics of all actions to ensure that a digital twin is operable [3].

References

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