

# The Open Digital Twin Platform (ODTP)

## The Prototype Digital Twin for Research the Swiss Mobility System

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ODTP Workshop

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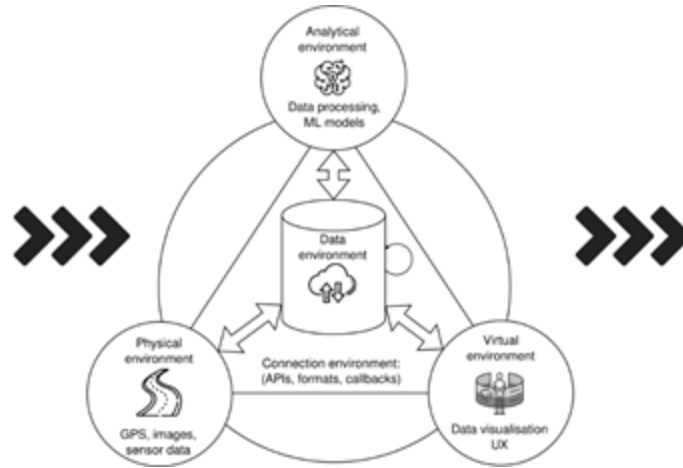
swissuniversities



- Introduction to ODTP
- Eqasim: ODTP 1st Case of Use
- ODTP Architecture
- Data Governance
- Semantics
- Development
- Demo



Physical Twin



Digital Twin

## ODT - Open Digital Twin of the Swiss Mobility System

A case of use for reusability by design and by default

- Development of a semantic standard for **open source digital twins** applied to mobility.
- **Privacy and security solutions** for dealing with highly sensitive data.
- Design of a **microservice architecture** compatible with analytical workflows involving multiple running ecosystems.
- Development of an **open-source platform that support traceability, reusability, inspection, and querying of digital twins**. The platform can be installed locally.
- Development of a **online repository** containing pointers to ODTP community products.

# ODTP core features are a implementation of ORD best practices



**CLI / Web-  
based UI**



**Analysis  
tracker/  
Traceability**



**Workflow  
manager**



**Analysis  
comparison**



**Container-  
based analysis**



**Data  
governance  
/ License  
manager**



**Semantic  
validation**

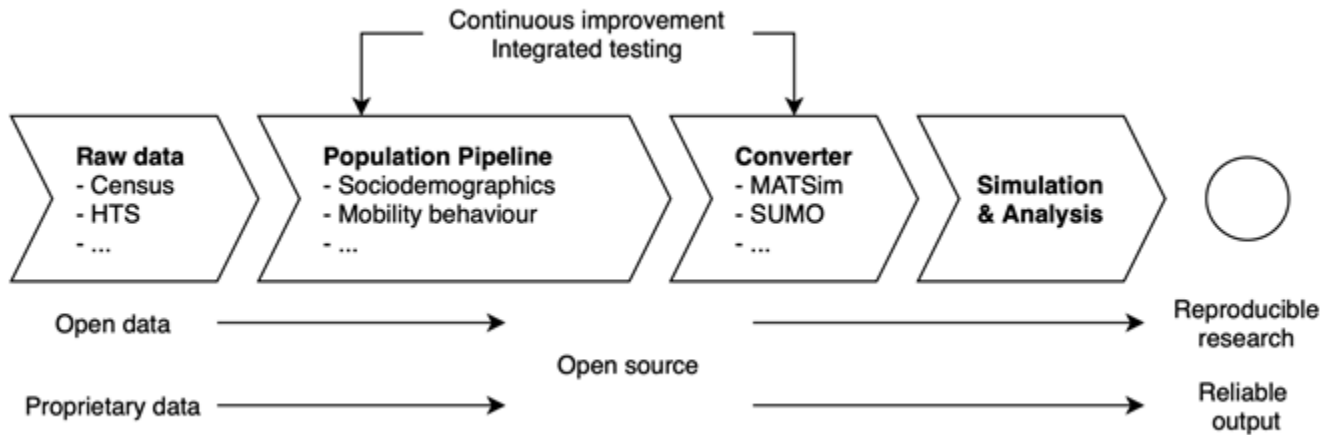


**Snapshots  
Storage**

# Eqasim

## ODTP: 1st case of use.

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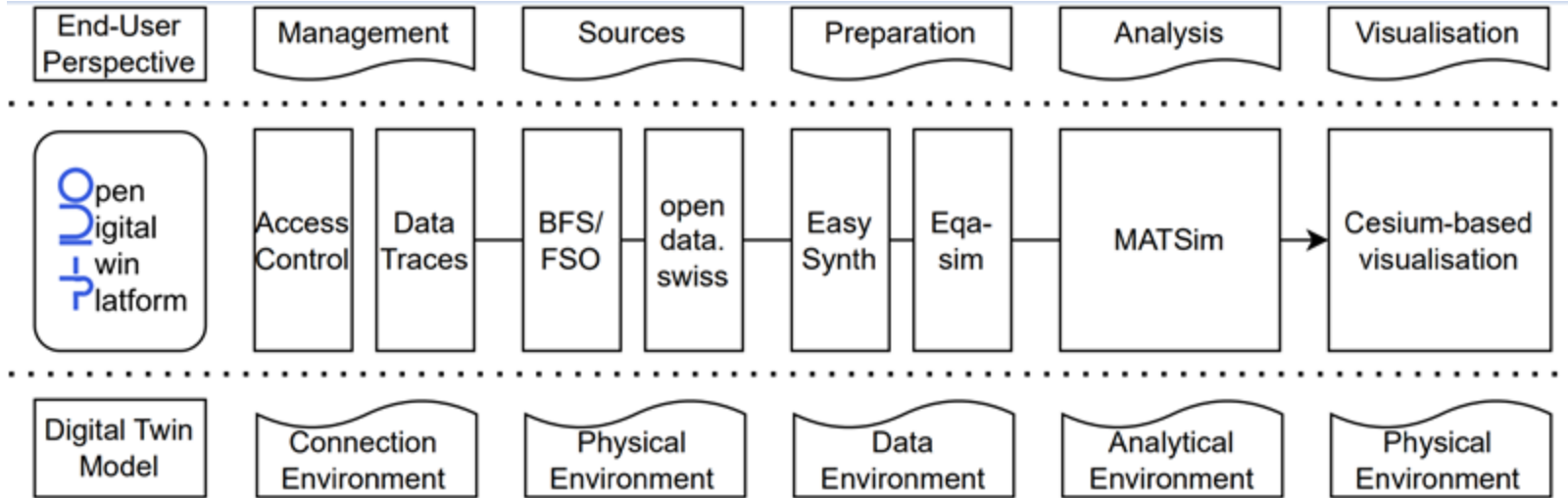
Working scenarios: Île-de-France, Switzerland, and Corsica.

Eqasim. Sebastian Hörl, Milos Balac, et al.

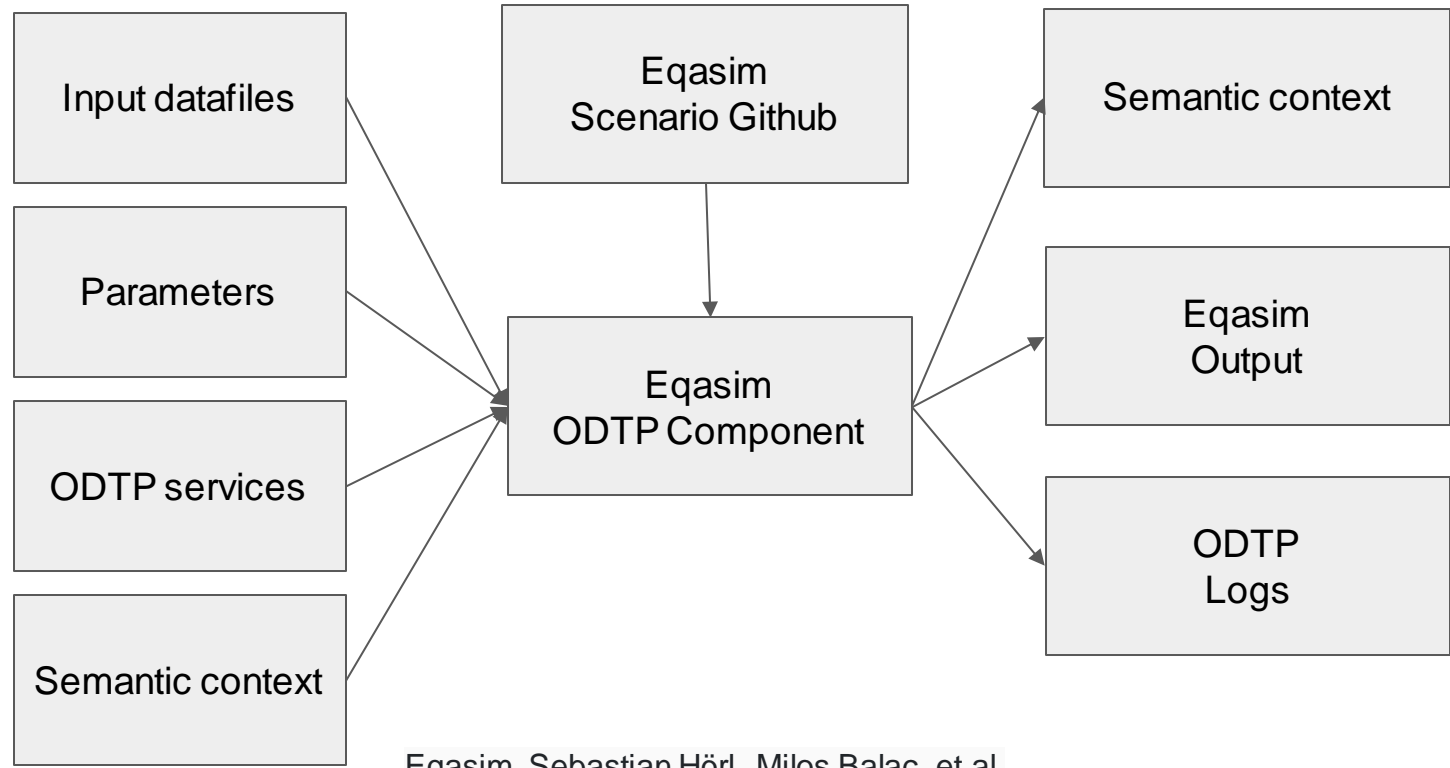
eqasim

powered by  
MATSim

Simunto





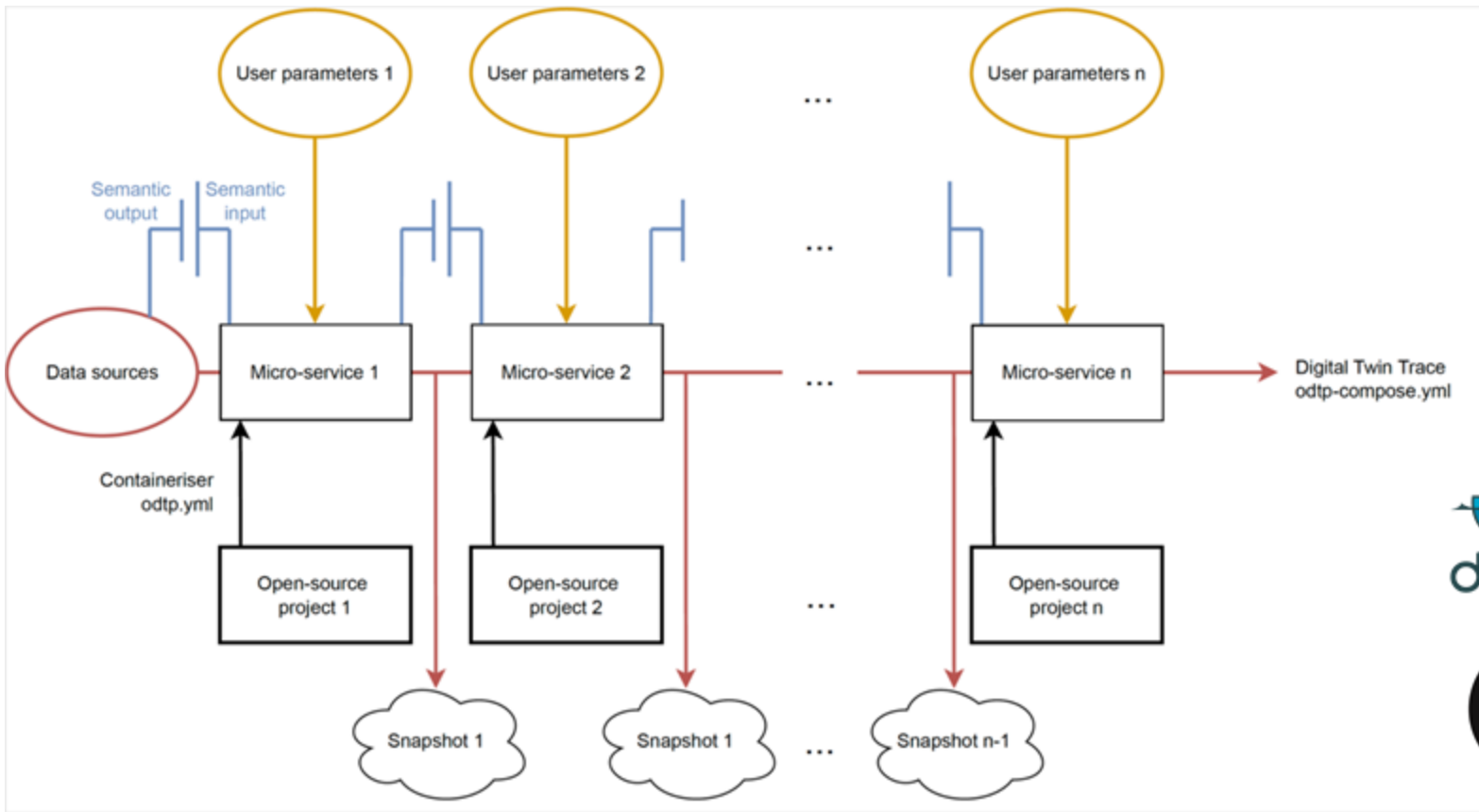


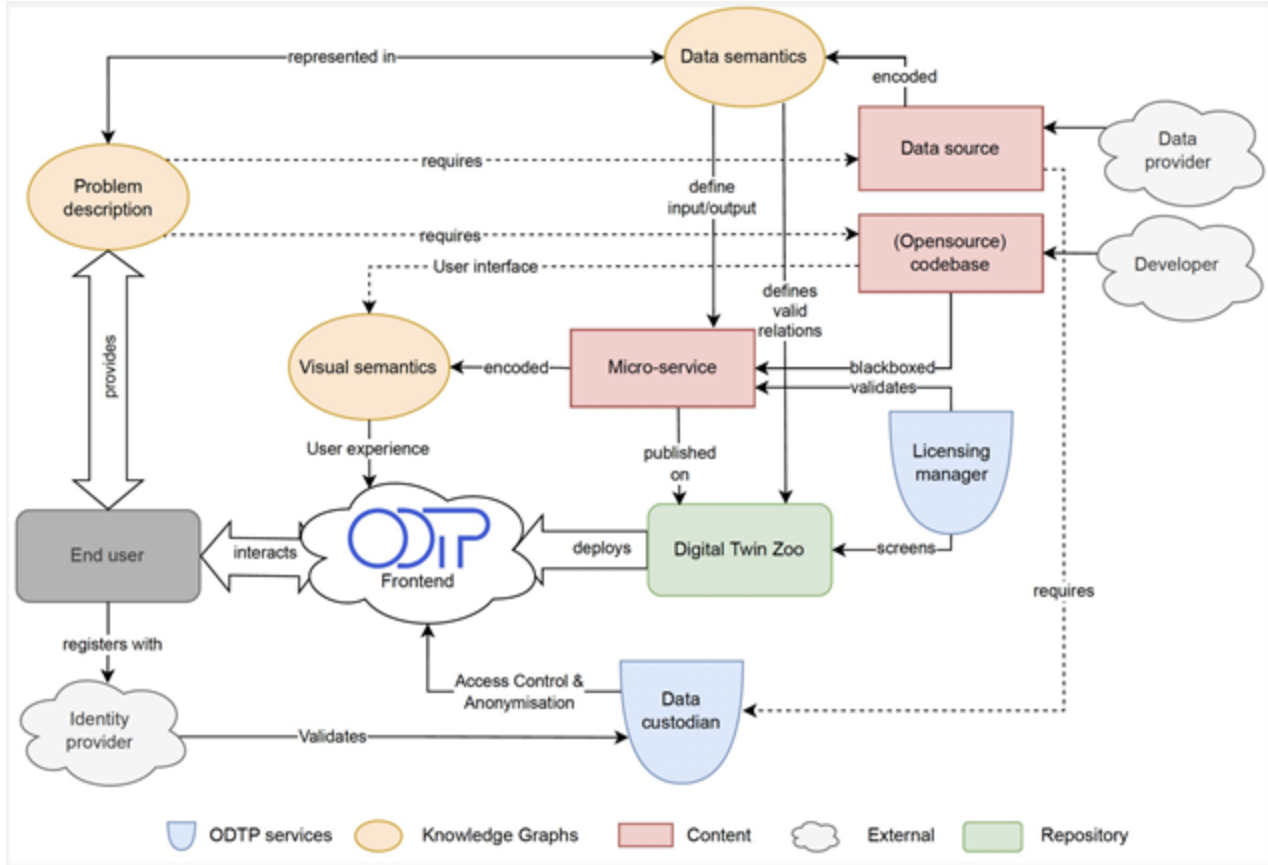
Eqasim. Sebastian Hörl, Milos Balac, et al.

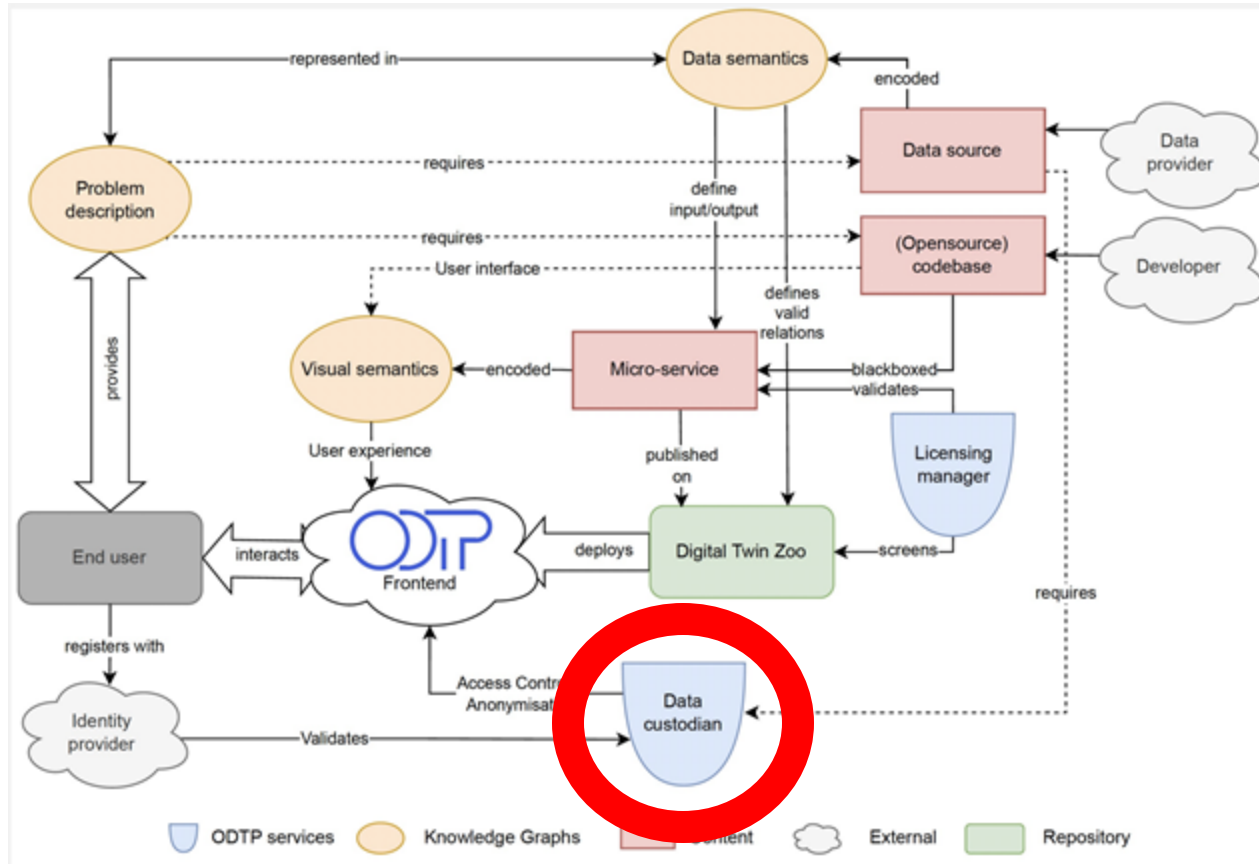
# ODTP Architecture

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# Digital Twin representation







# ODTP Governance, Confidentiality and Security

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# WHY

Digital Twin Platform Security, Confidentiality Issues



## Data breaches

Exposes confidential, protected information to an unauthorized person

## Unauthorized Access

- Target for cyberattacks
- Data pipeline and storage can be compromised

## Non compliance with regulation

- FADP
- GDPR



# HOW

Mitigating Confidentiality and Security Risks in ODTP

## Access control

Ex: The users, applications, and services that interact with the data pipelines



## Encryption

Ex: Ensure that data is encrypted according to sensitivity and value, type, source, and destination

## Data Governance



## Privacy Preservation

Ex: Combine the technical measures, such as data anonymization and encryption, and regulatory measures

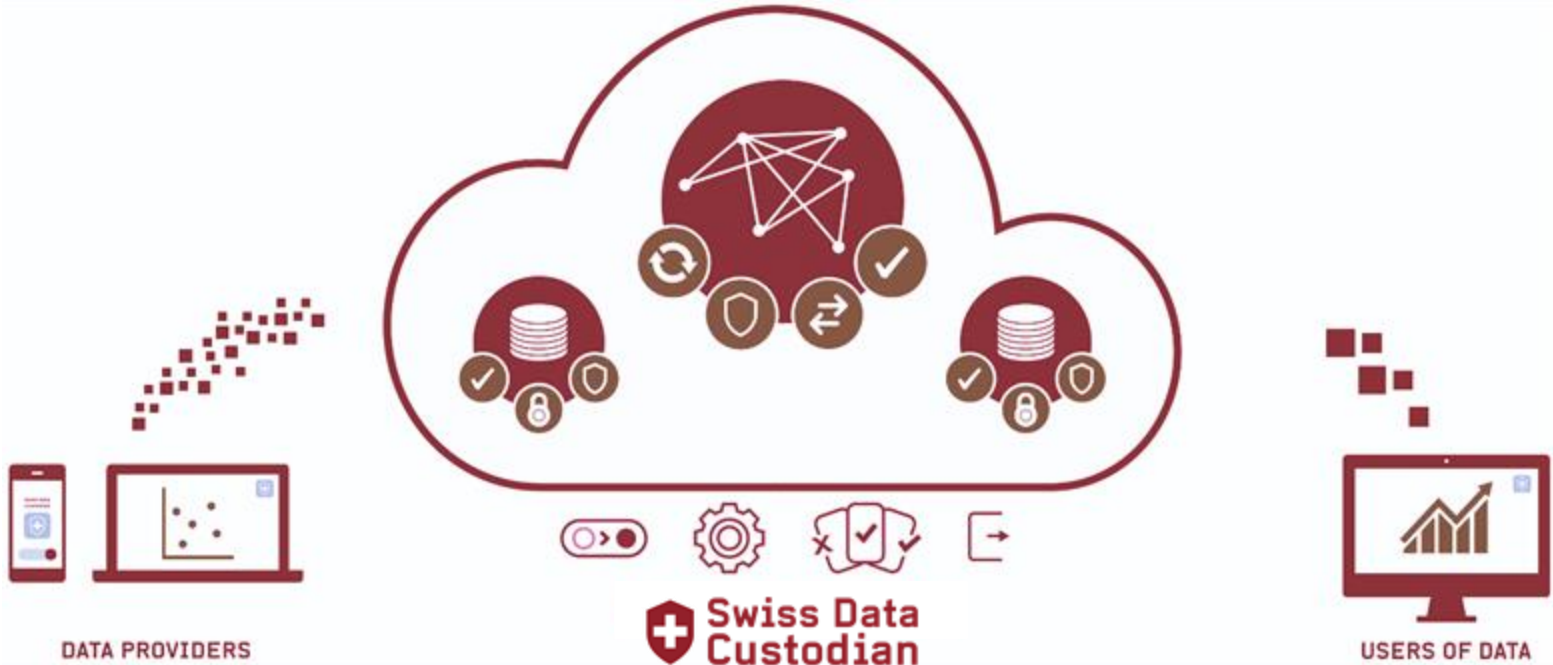


## Monitoring

Ex: Audit and log the activities and events that occur in data pipelines

# A dynamic privacy-based access control and governance

According to the terms of human and machine-readable digital contracts



# Governance



## Contract Generation

Create tailored templates for data governance contracts to meet the specific needs of involved parties.



## Contract Review

Automatically review contracts for compliance with relevant laws and regulations.

## Contract Monitoring

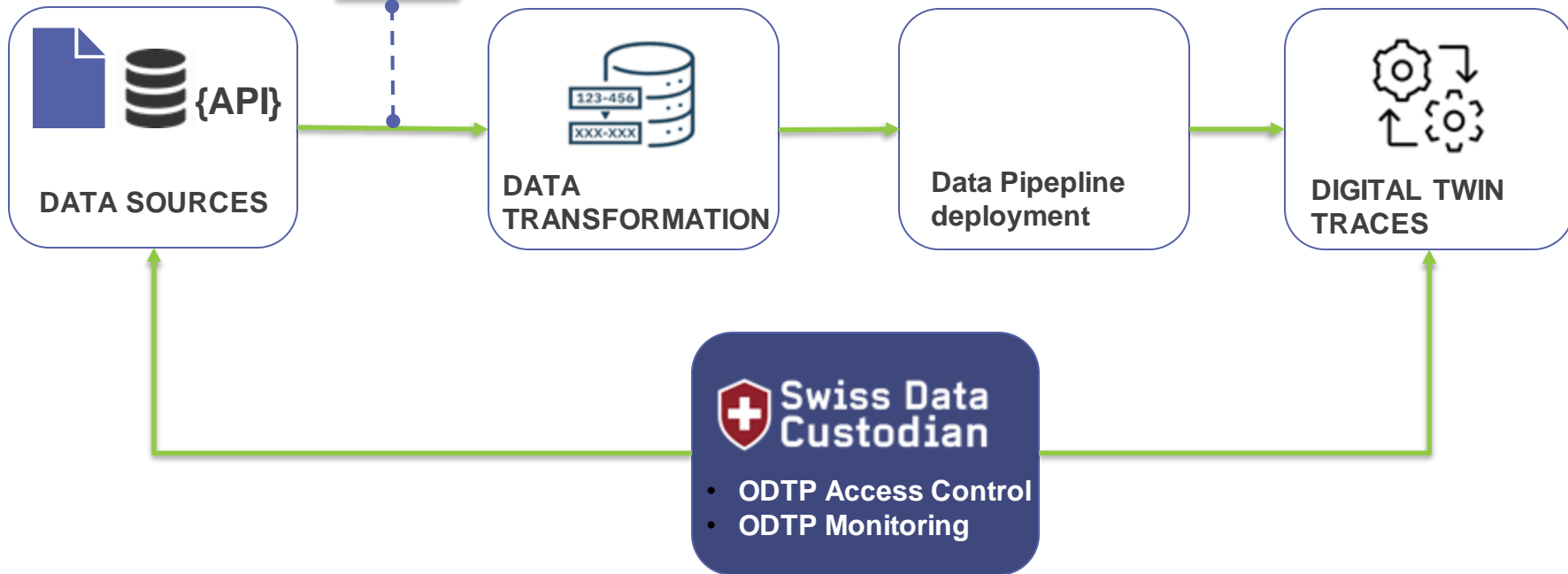
Track and ensure ongoing compliance and implementation of data governance contracts over time.

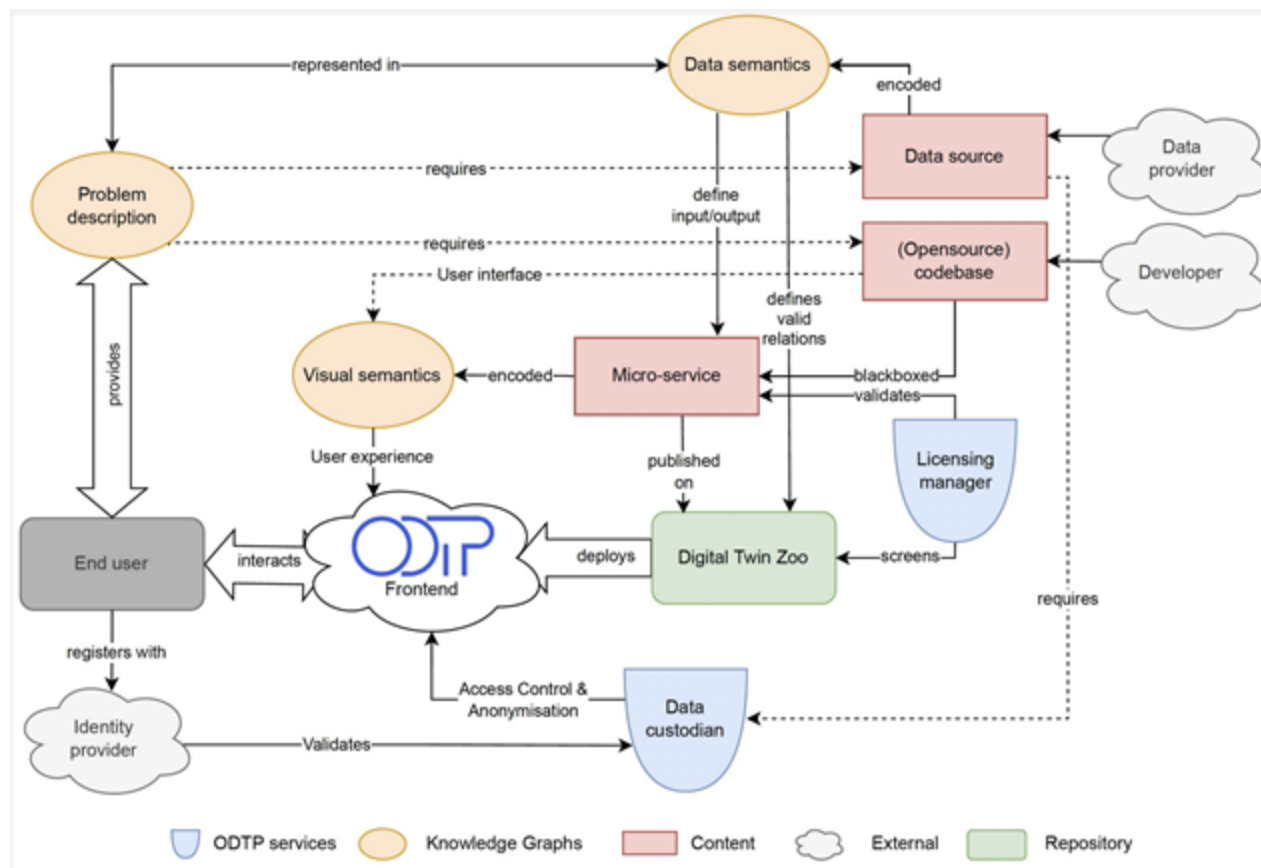
- Semantic Data Shape
- Privacy Requirements
- Consent (legal ground)
- 

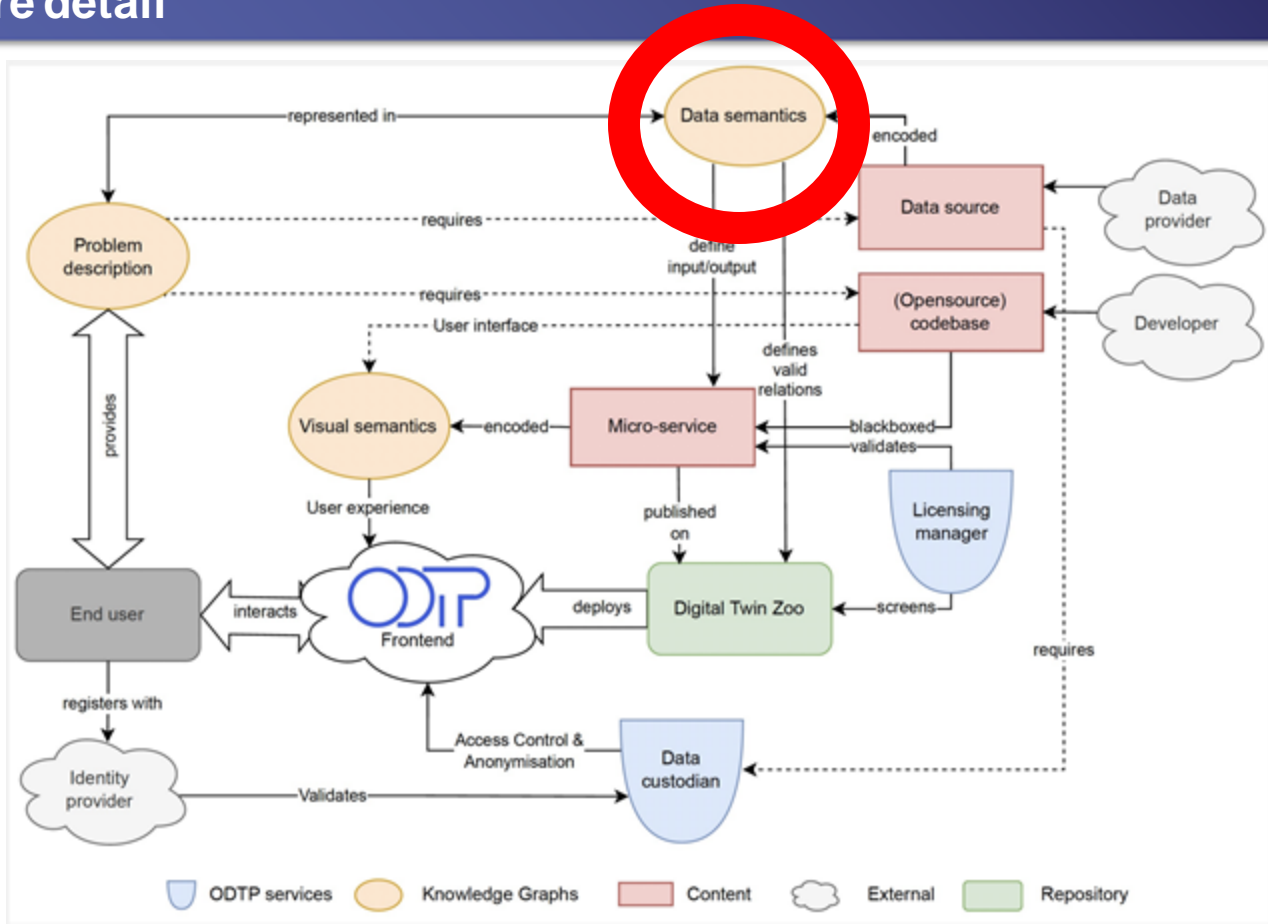


- Data collection
- Synthetization
- Pseudonimization
- Anonymization

- Rules for deploying









# ODTP Semantics

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User has a dataset

User wants to use your tool

Your tool is not built for their dataset (except Eqasim haha)

Those requirements should be:

- Human readable
- Flexible/expandable
- Computer verifiable

## Automated verification of file folders:

1. Look inside folder
2. List files
3. Compare list with required list of files
4. Go into file
5. Look at column headers
6. List column headers
7. Compare list with required list of variables
8. (optionally) check datatype of random samples
9. Give user feedback on what files/variables are missing/wrong

## Meaning negotiation

- Definitions, labels, datatypes and other restrictions make it possible for humans to interpret whether their variable “means the same” as the one requested.

## Translation

- Capturing languages of labels with synonyms allows easy translation between datasets in different languages



## From strings to things

- If people re-use variables explicitly defined on the web, you can refer to them, rather than re-defining them yourself.

| ID       | Werkt | Inkomen_brutto | OV_abbo_sinds | Dalurenkaart |
|----------|-------|----------------|---------------|--------------|
| 12345abc | Ja    | 3850           | 13 juni 2017  | Ja           |
| ...      | ...   | ...            | ...           | ...          |

| ID      | Employed | Income_before_tax | Public_transport_subscription_since | Off-peak_hours_discount_card |
|---------|----------|-------------------|-------------------------------------|------------------------------|
| 4567def | True     | \$4000            | 07-08-2012                          | True                         |
| ...     | ...      | ...               | ...                                 | ...                          |

| GUID1     | GUID2 | GUID3 | GUID4    | GUID5 |
|-----------|-------|-------|----------|-------|
| asdfh3487 | False |       | 01/02/04 | True  |
| ...       | ...   | ...   | ...      | ...   |

| Variable name   | Income_gross  | Employed    | Public_transport_subscription_since |  |
|-----------------|---|-------------|-------------------------------------|---|
| Label (en)      | Gross Income  | ...         | ...                                 |  |
| Label (de)      | Bruttoeinkommen   | ...         | ...                                 | ...   |
| Label (nl)      | Brutto Inkomen  | ...         | ...                                 | ...   |
| Label (fr)      | Revenu Brut   | ...         | ...                                 | ...   |
| Definition (en) | an individual's total earnings before taxes or other deductions.            | ...         | ...                                 | ...   |
| Definition (de) | der Gesamtverdienst einer Person vor Steuern oder anderen Abzügen.          | ...         | ...                                 | ...   |
| Definition (nl) | het totale inkomen van een individu vóór belastingen of andere inhoudingen. | ...         | ...                                 | ...   |
| Definition (fr) | le revenu total d'un individu avant impôts ou autres déductions.            | ...         | ...                                 | ...   |
| Datatype        | xsd:decimal   | xsd:boolean | xsd:date                            |   |



# Development

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The screenshot shows the GitHub repository page for `odtp-org`. The page is titled "odtp-org" and has a search bar with the text "Type / to search". Below the search bar, there are navigation tabs for Overview, Repositories (6), Discussions, Projects (1), Packages, Teams, People (8), and Settings. The main content area displays a list of repositories with filters for Type, Language, and Sort, and a "New repository" button. The repositories listed are:

- `odtp` (Private): Python, AGPL-3.0, 0 stars, 0 forks, 0 issues, updated 1 hour ago.
- `odtp-component-template` (Private template): Python, AGPL-3.0, 0 stars, 0 forks, 0 issues, updated 1 hour ago. Description: "This is a template that facilitates the development of new odt-components".
- `odtp-eqasim` (Private): Dockerfile, AGPL-3.0, 0 stars, 1 watch, 0 forks, 0 issues, updated 16 hours ago. Description: "Exploration of eqasim".
- `odtp-ontology` (Private): 0 stars, 0 forks, 0 issues, updated on Aug 10.
- `odtp-manuals` (Public): All manuals, instructions, documentation and information you need to work with OOTP. AGPL-3.0, 0 stars, 0 forks, 0 issues, updated on Aug 8.
- `.github` (Public): Read me for OOTP. AGPL-3.0, 0 stars, 0 forks, 0 issues, updated on Jul 25.

At the bottom of the page, there is a footer with the text "© 2023 GitHub, Inc." and links for Terms, Privacy, Security, Status, Docs, Contact GitHub, Pricing, API, Training, Blog, and About.

<https://github.com/odtp-org>



odtp-component-template

Your main branch isn't protected

caviri first commit

odtp-component-template

This is a template that facilitates the development of new odtp-components. Please follow the next steps to adapt your tool.

### Use of the template

Depending on the type of tool you may want to follow one of these procedures.

### Scripts in a repository (or tool under development)

1. Identify which parameters would you like to expose.
2. Configure the Dockerfile to pull your repos and install all needed dependencies.
3. Configure dependencies in requirements.txt if the dependencies offered in the repos are not compatible with the docker image.
4. Configure the `docker-compose` file to run the tool.
5. (Optional) Make use of `config_templates` if your tool requires the generation of a `config.yml`.
6. Describe all the metadata in `odtp.yml`.
7. Publish your tool in the ODTF Zoo.

Tool published in PIPYConda/R

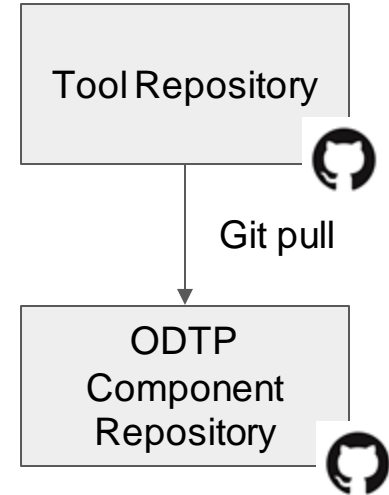
Adding Semantic Context.

odtp-component-template / odtp.yml

caviri first commit

Code Blame 27 lines (26 loc) · 574 Bytes Code 55% faster with GitHub Copilot

```
1 # This file should contain basic component information such as
2
3 - name: Name of your tool
4 - repo: Repo of your tool
5 - author: Author of the Component
6 - original_author: Author of the tool
7 - description: Small description of your tool
8 - arguments:
9   - options: [optionA, optionB]
10  - float: 0.001
11  - integer: 1234
12  - string: 24G
13 - volume:
14   - data: /odtp/odtp-volume/data
15 - ports:
16   - api: 7100
17   - logger: 7101
18 - devices:
19   - gpu: False
20 - inputSchema: ...
21 - outputSchema: ...
22 - env:
23   - MONGODB_CLIENT
24   - S3_SERVER
25   - S3_ACCESS_KEY
26   - S3_SECRET_KEY
27   - S3_BUCKET_NAME
```



# Demo

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- Integrate ODTP with semantic technologies (WIP)
- Integrate ODTP with Swiss Data Custodian (WIP)
- Implement Eqasim with Semantics & Data Governance solutions.
- Develop ODTP component for Interpretable and Robust Machine Learning for Mobility Analysis (Yanan's project)
- Develop ODTP for Chenyu's Eqasim visualization tool.
- Publish ODTP zoo for open components.

# Thank you! Questions?

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