IDEA4RC

Artificial Intelligence in head and neck cancer research

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Artificial intelligence

The ability of a system to correctly interpret external data, to learn from that data and to use that knowledge to achieve specific tasks and goals through flexible adaptation.

REASONING → PLAN → LEARN → UNDERSTAND → PERCEIVE

Artificial intelligence

- **Machine Learning:**
  - A system that can improve prediction using historical or observational data.
- **Natural Language Procesing**
  - Systems that can understand human language for knowledge acquisition.
- **Robotics**
  - Physical systems that manipulate the physical world.
- **Expert Systems**
  - Systems that make decisions using user-defined systems.

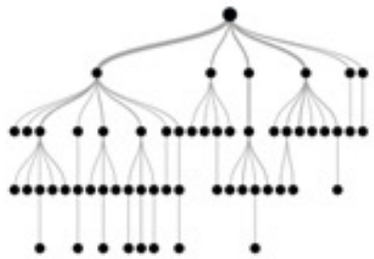
Artificial intelligence

- **Unsupervised learning:**
    - Systems that learn patterns from inputs
    - Predicting a structure (Patient clustering)
    - Dimension reduction (Variable clustering)
- **Supervised learning:**
    - We have input and output data
    - Predict a category (recurrence/death)
    - Predict a value (severity of symptoms)

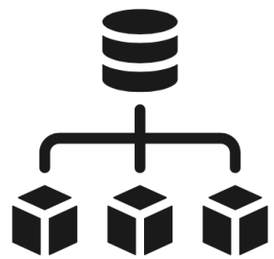
Artificial intelligence in HNC research

Increased number of patients

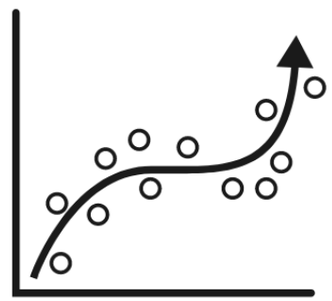
More diverse patient profiles



Increased number of variables



Homogenisation of data entry



Robust predictive models

REAL WORLD EVIDENCE: BROADER AND DEEPER APPROACH

IDEA4RC

Intelligent Data Ecosystem for Rare Cancers

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What is it about?

- IDEA4RC is a funded Horizon Europe project led by Istituto Nazionale dei Tumori (Milan, Italy).

- The project will stretch over the course of four years (September 2022 - September 2026)

- Its objective is building an **intelligent ecosystem to improve the governance, the sharing, and the re-use of health data for rare cancers**

Why do we need such an ecosystem?

- Every year in Europe 650’000 people receive a **rare cancer** diagnosis. Taken together they represent **nearly 25% of all cancer diagnoses** in the continent.

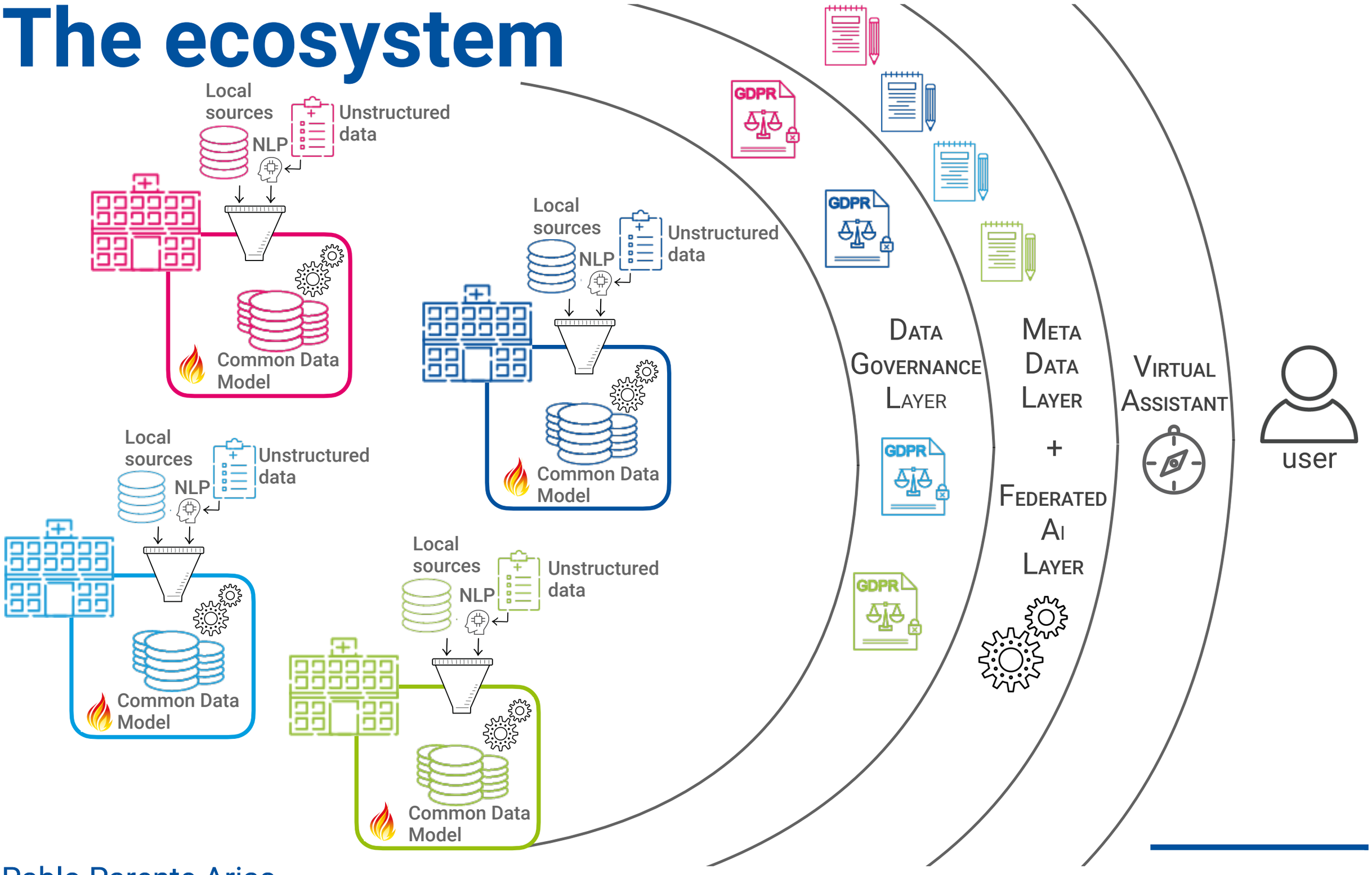
- Analysing **large and diverse datasets** collected by different clinical centers and countries would greatly advance the knowledge on rare cancers.

- Current hurdles include:
  - **lack of interoperability**,
  - compliance with **EU data protection requirements** when sharing health data.

The principles

- IDEA4RC plans to develop a **new IT infrastructure:**
    - D**ata protection and privacy by design and by default** required by EU regulations
        - Complies with the **FAIR principles** of scientific data management (Findability, Accessibility, Interoperability, and Reusability).
- The ecosystem will be tested on pilot projects
    - involving **11 centers of excellence of the EURACAN network**

The ecosystem



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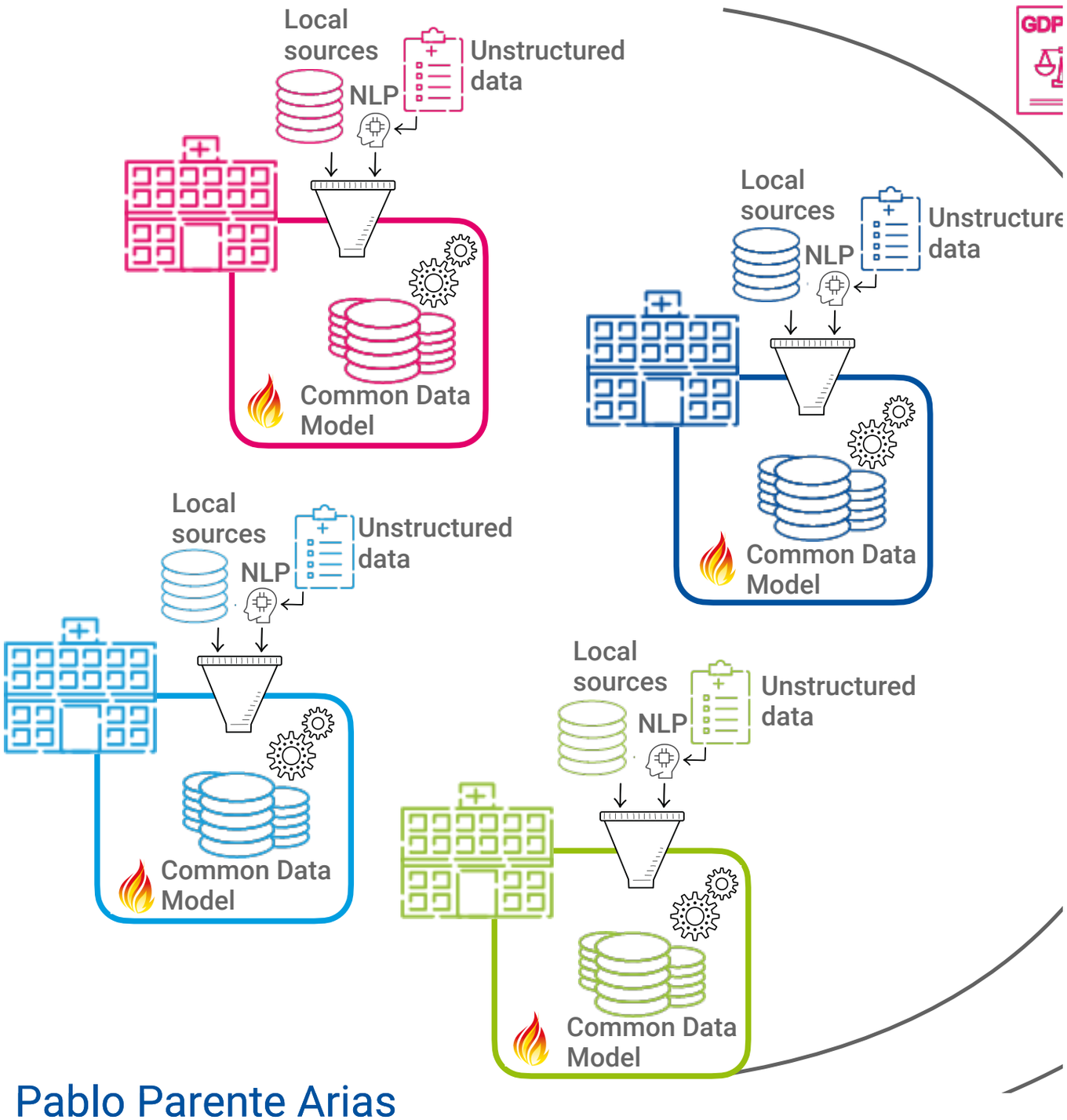
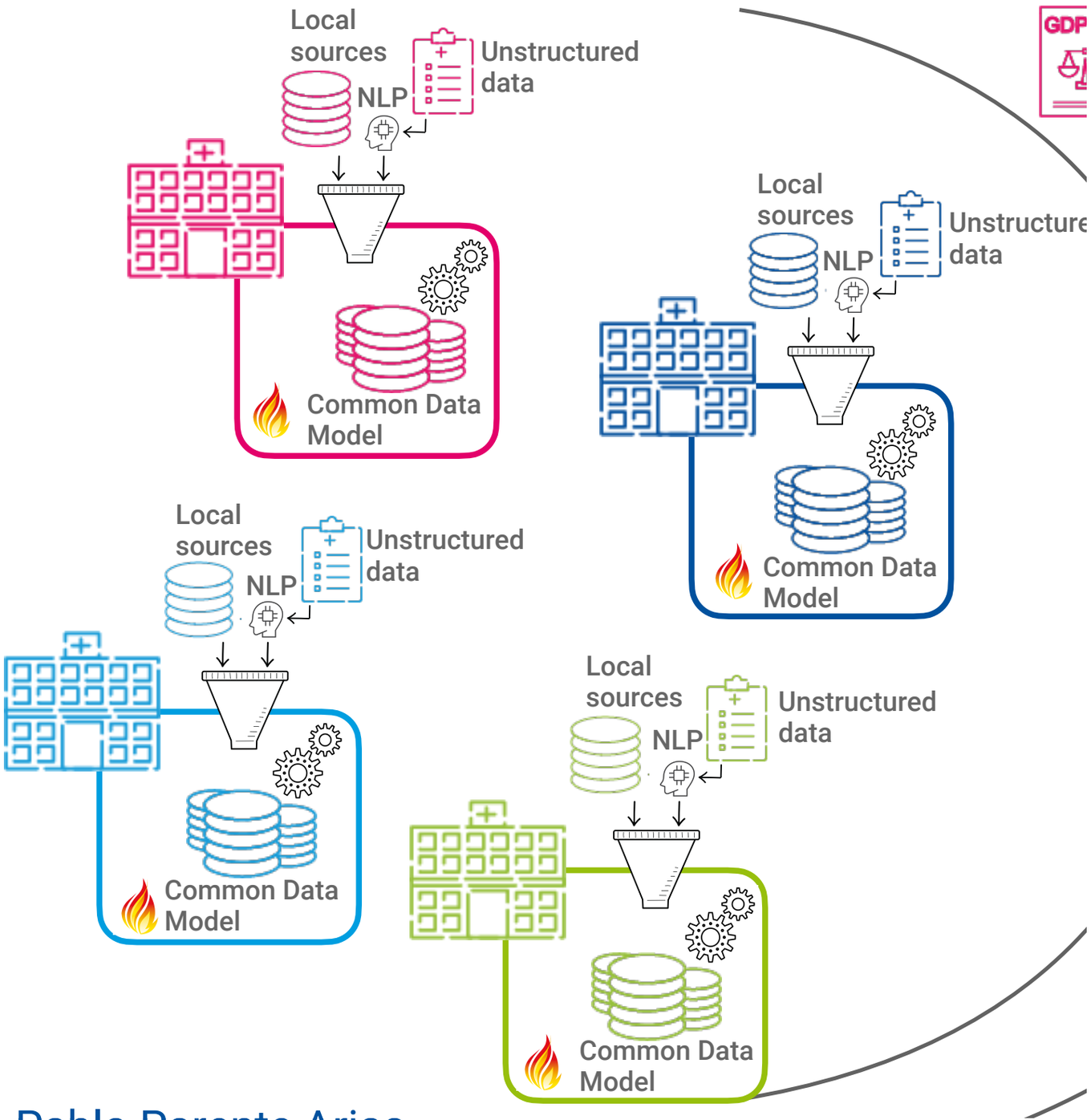
The ecosystem



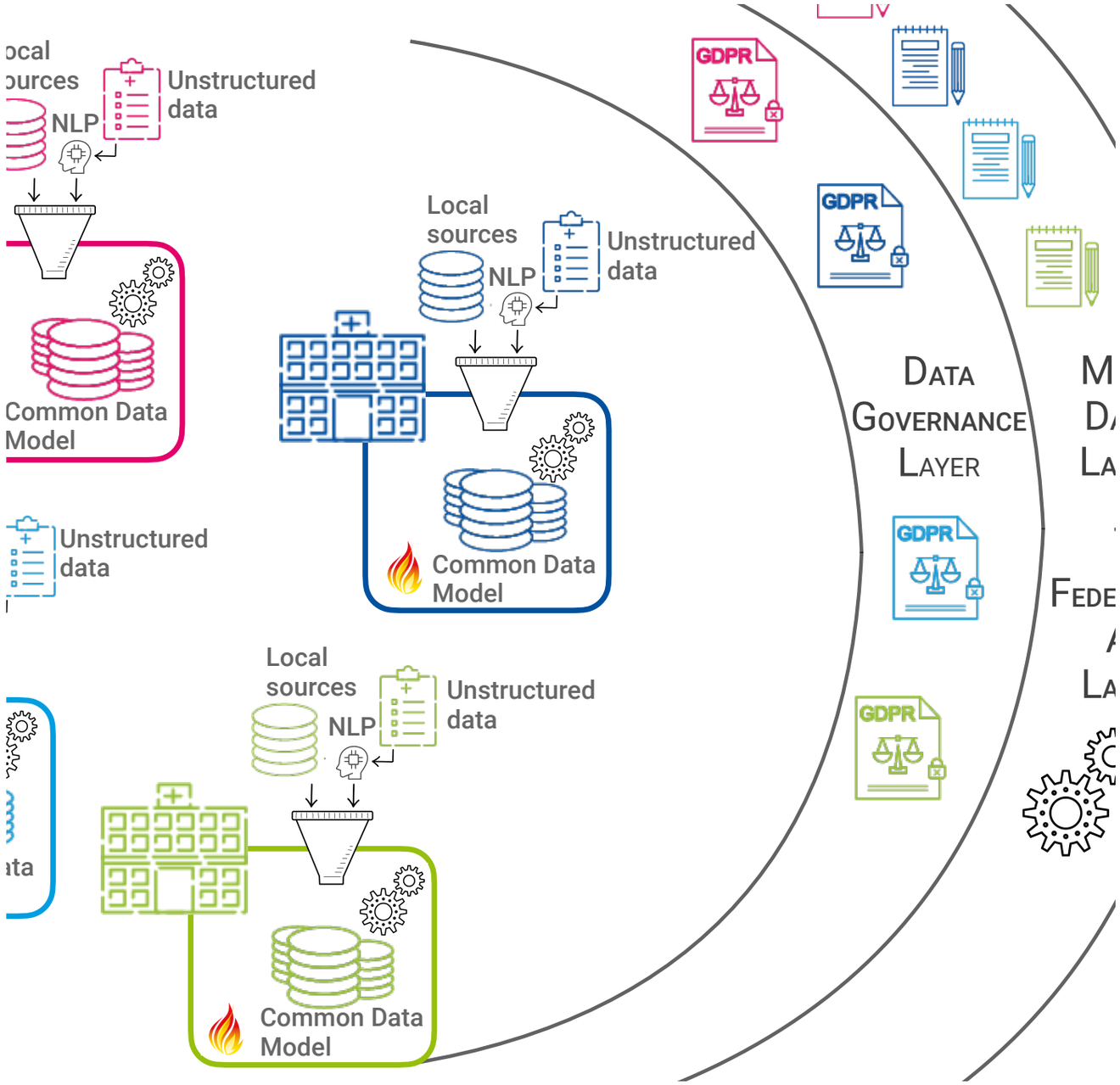
1. **Data doesn’t leave their original location.**
2. **The data of each center will be translated in a common data format and stored in “data capsules”, a secure processing environment**
3. **Unstructured data will be exploited thanks to the development of dedicated machine learning algorithms**

The ecosystem



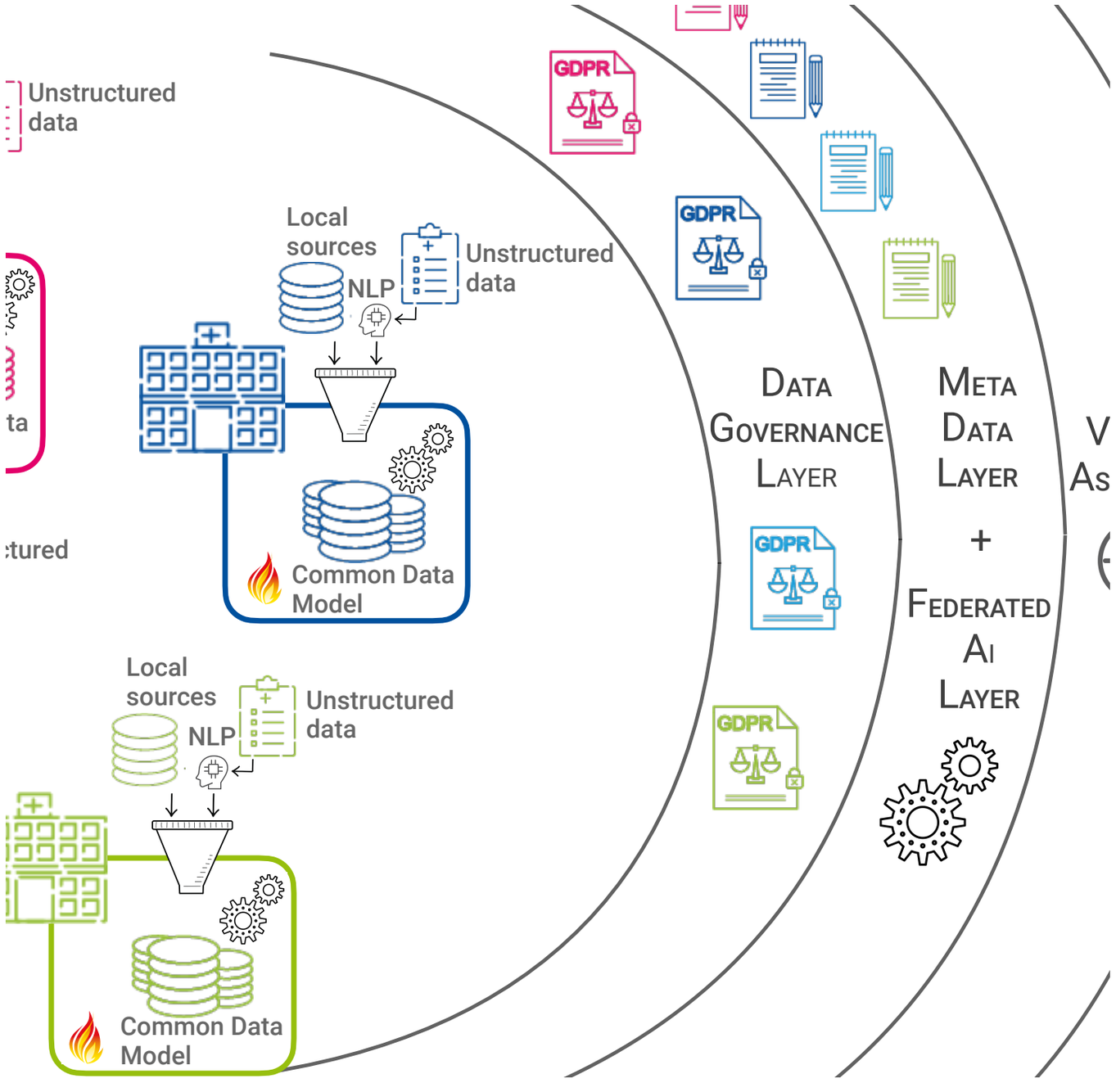
4. **The algorithms needed for the analyses, specified in the Federated AI layer, will be executed locally and iteratively over each dataset until they converge**

The ecosystem



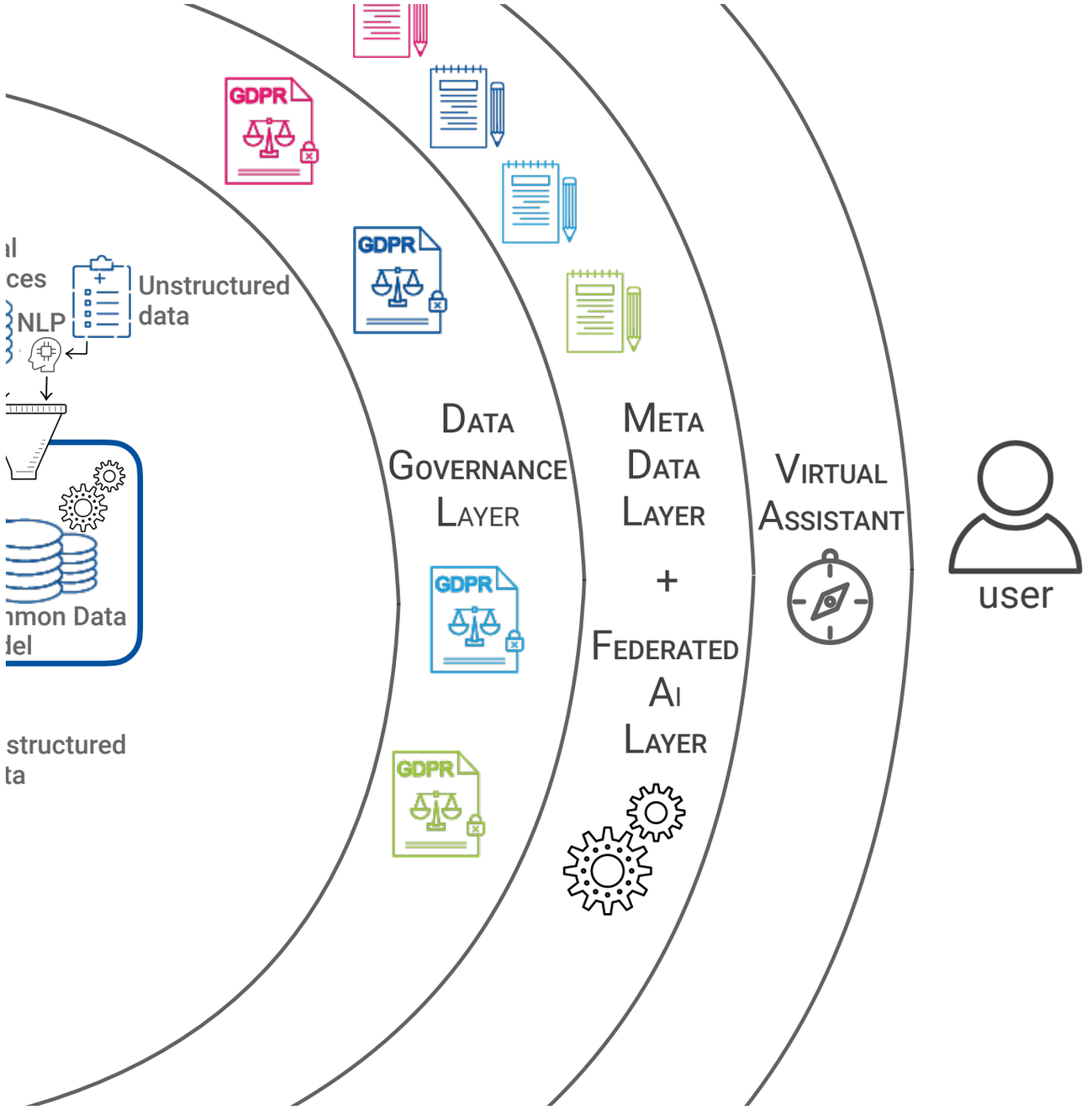
5. **The access to each dataset will be regulated by a data governance layer implementing the principles of data protection and privacy by design and by default required by EU regulations.**
6. **The governance layer and the entire ecosystem will be designed in order to take into account the values of the different stakeholders involved in the rare cancers care.**

The ecosystem



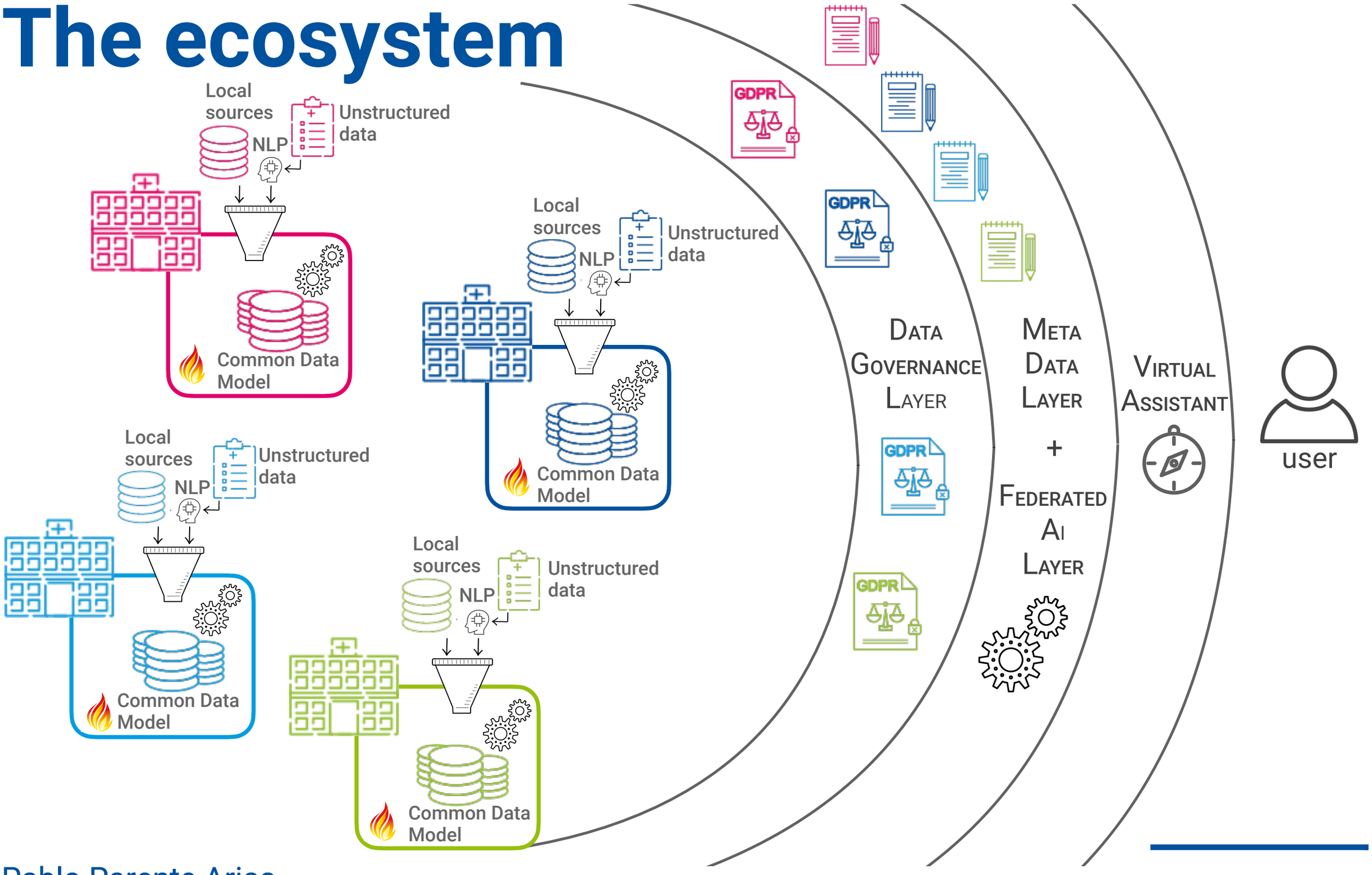
7. **The meta data layer will clarify which data each center share with the ecosystem, so that the user who is setting up the analysis knows which capsules can contribute.**

The ecosystem



8. **Virtual assistant will be developed to access the ecosystem, selecting relevant cohorts of patients and running analyses. The assistant will be designed having in mind different kind of users: researchers, clinicians, IT experts and data administrators.**

The ecosystem



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The consortium

25 partners with a wide range of expertise

11 clinical centres in **8 countries**

led by **Istituto Nazionale dei Tumori** (Milan, Italy)

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The consortium

CLINICAL CENTERS

TECHNICAL PARTNERS

SUPPORT CENTERS

IDEA4RC

Thank you

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