



Project ATHENA

Augmenting Therapeutic Effectiveness through Novel Aalytics

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**AGENTSCHAP
INNOVEREN &
ONDERNEMEN**



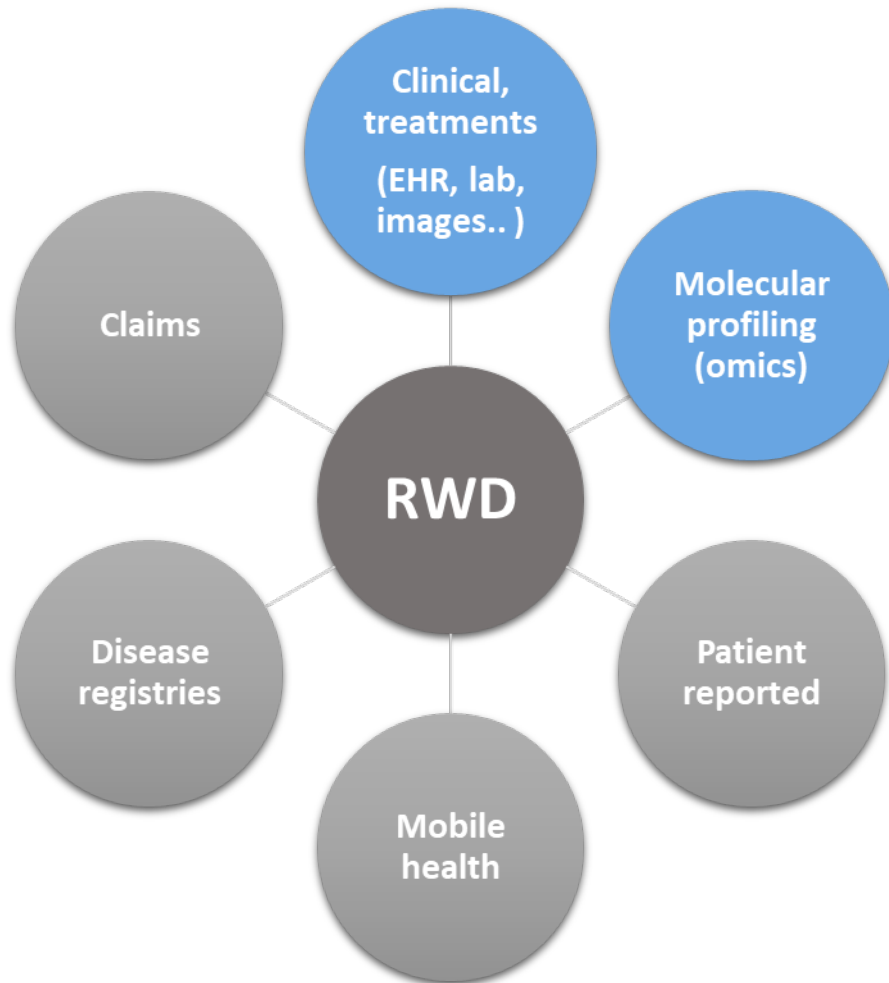
Vlaanderen
is ondernemen

Project number ATHENA: HBC.2019.2528

Outline

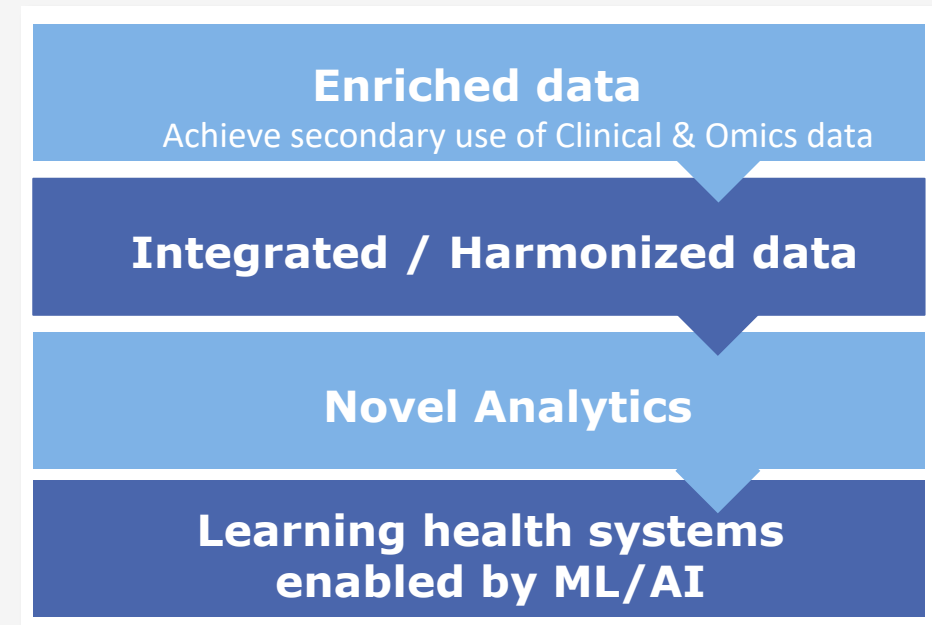
- Background
- Project ATHENA
 - Objective
 - Principle of federated machine learning (ML)
 - Architectural goals
 - The platform
- External collaborations – consortium
- Scalability and future of ATHENA
- Envisioned impact of ATHENA

Harnessing real-world evidence for the development of novel cancer therapies*



- **Novel analytic** techniques can bring together diverse data types to expand novel insights gained from RWE.
- **Enrichments of high-quality data coupled with machine learning** can help find areas of therapeutic need, enhance clinical trial interpretation, and even identify novel targets.

*Greshock et al., 2020

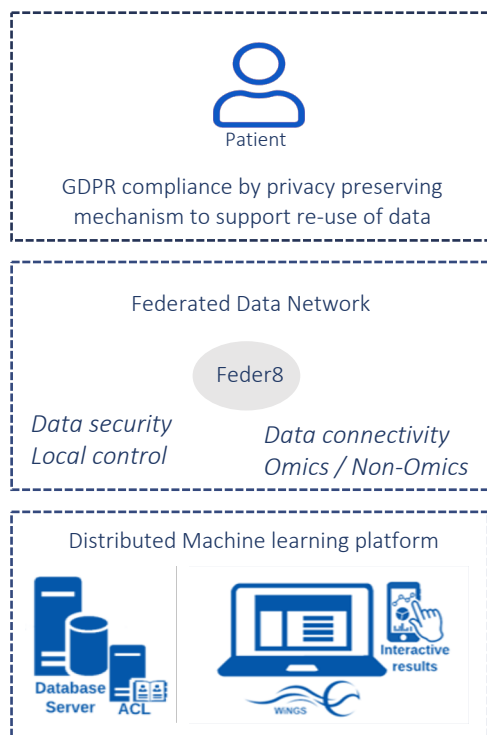


Augmenting Therapeutic Effectiveness through Novel Aalytics

Objectives of ATHENA

Personalised medicine is the streamlining of clinical decision making by distinguishing in advance those patients most likely to benefit from a given treatment from those who will suffer side effects without gaining benefit and incur cost

adapted from Hamburg, FDA, 2013



1

Accelerate data-driven precision medicine through data (clinical, omics, images) mobilisation and insights generation to support care, improve survival and inform research.
(**Multiple Myeloma and Bladder cancer** will serve as a template for other cancer types)

3

Help HCPs to **deliver better targeted treatments** more effectively and proactively to patients. Explore the potential of care pathway automation

2

Apply advanced analytical methods to generate new markers and/or algorithms to **stratify patients** with regards to their possible response to treatment

4

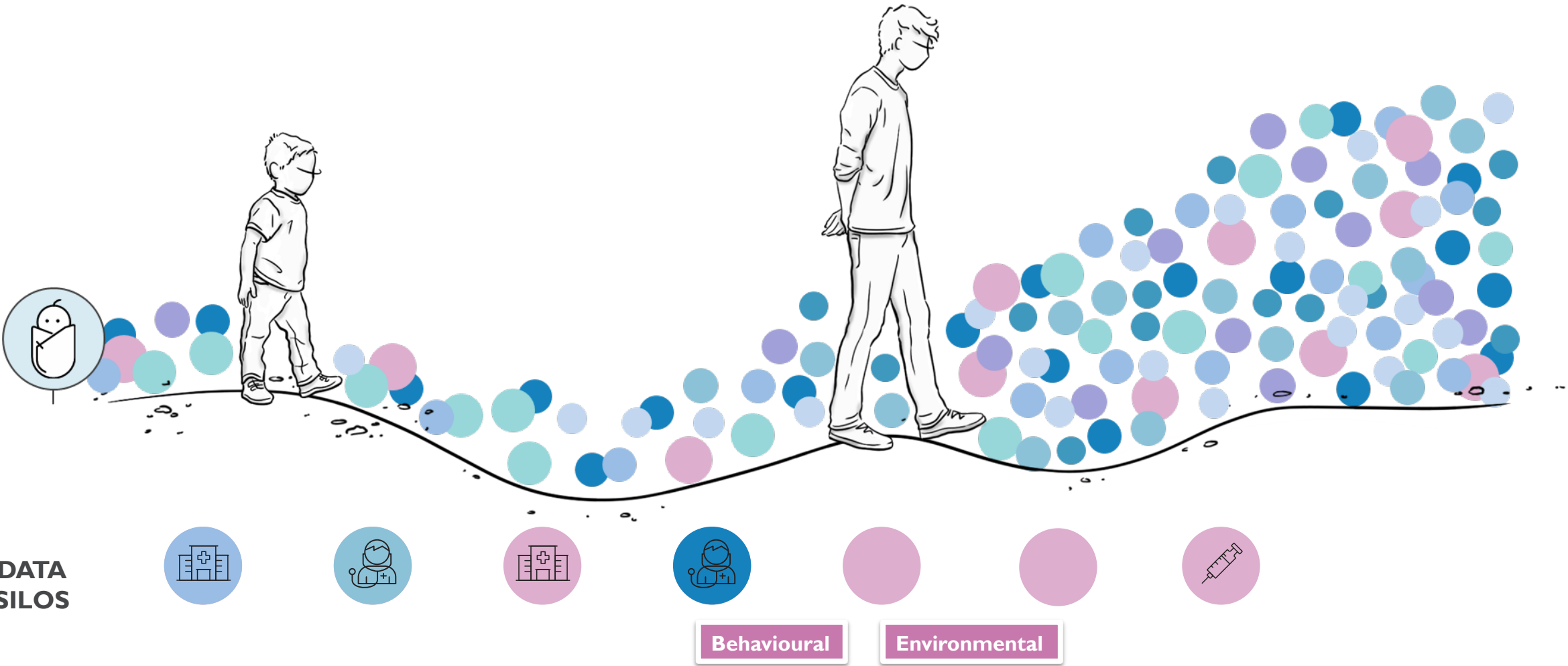
Pioneer new understandings in oncology care through **integrating care and research**, that can lead to improved outcomes for each patient.

Providing solutions to ethics, consent and data governance, data quality, interoperability and sustainability

Principle of federated machine learning (ML) and ATHENA architectural goals

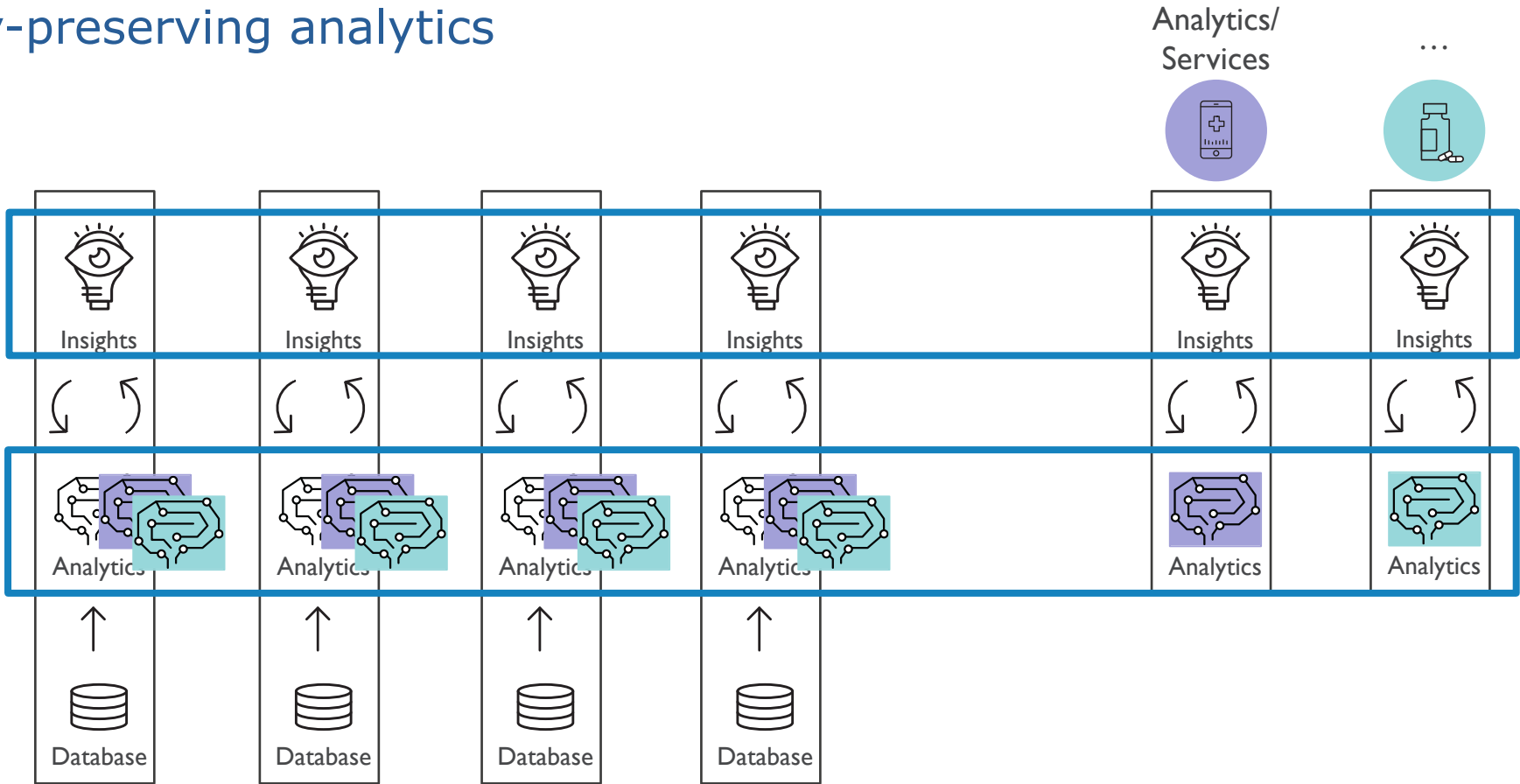
More and more data is being gathered

Ushering in the age of personalized healthcare



Principle of federated learning

Privacy-preserving analytics



Federated insights:
Only share insights derived
through the models

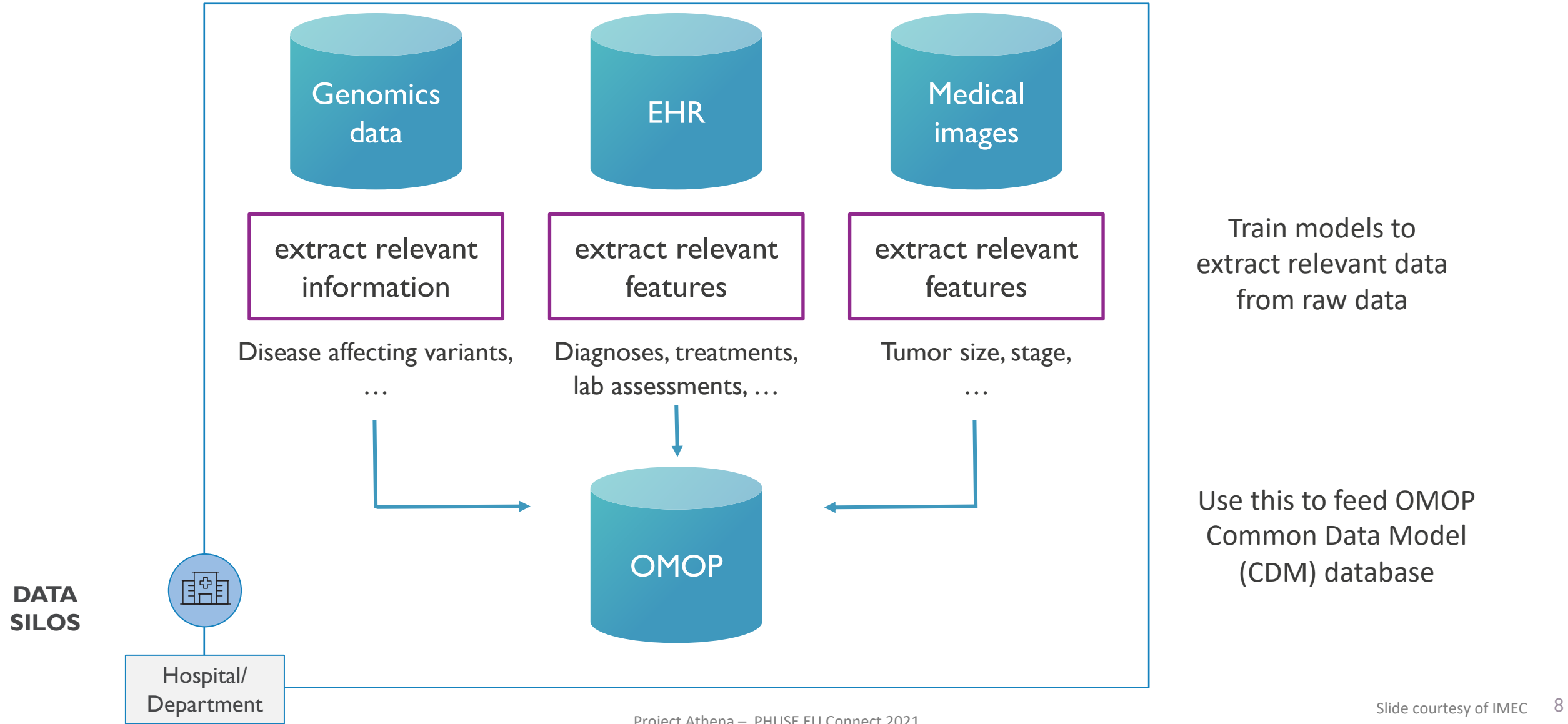
Federated machine
learning:
models are pooled;
data remains private

DATA
SILOS

Hospital/
Department Hospital/
Department Hospital/
Department ...

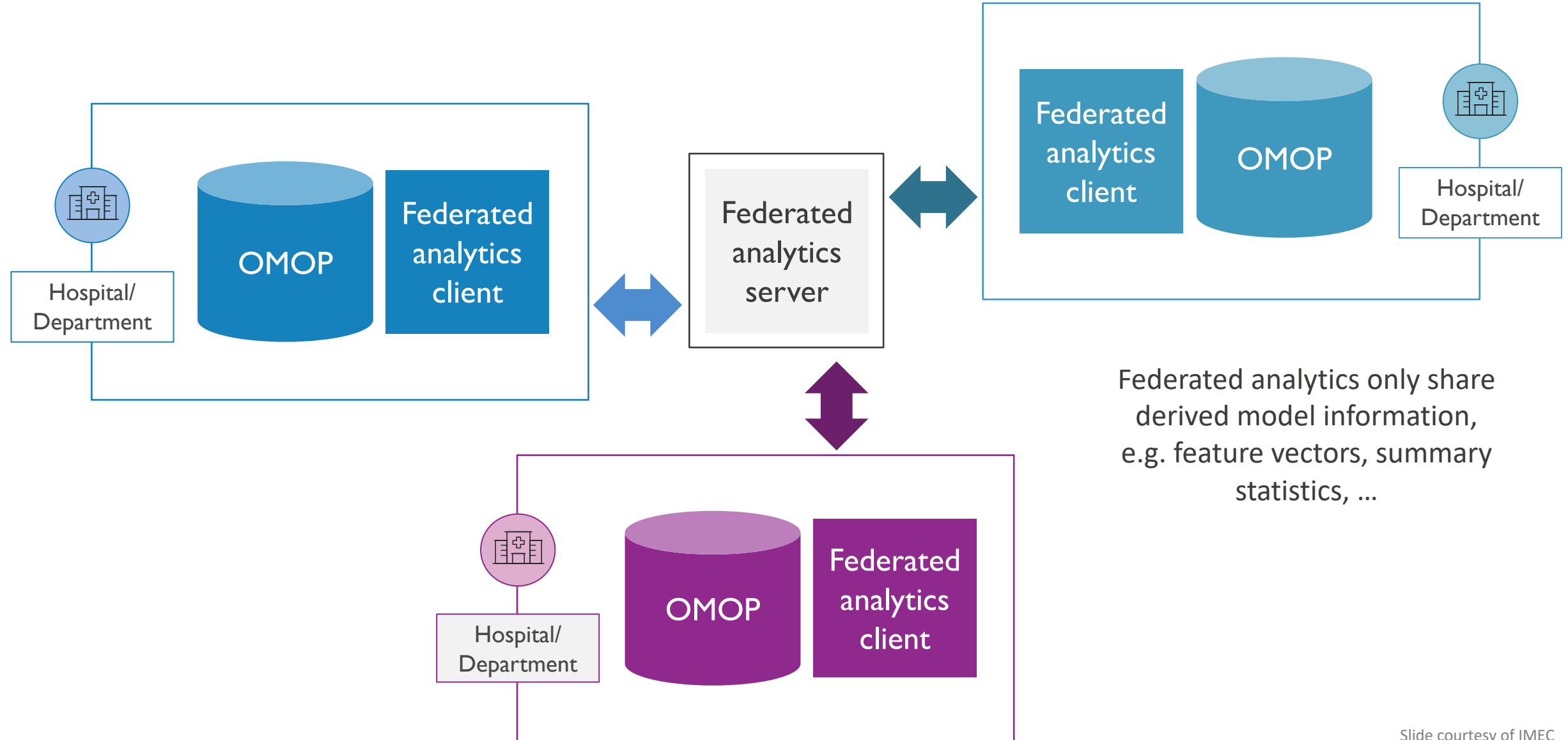
Combine data within hospitals - harmonize data across hospitals

Extract information from raw data to feed local OMOP database



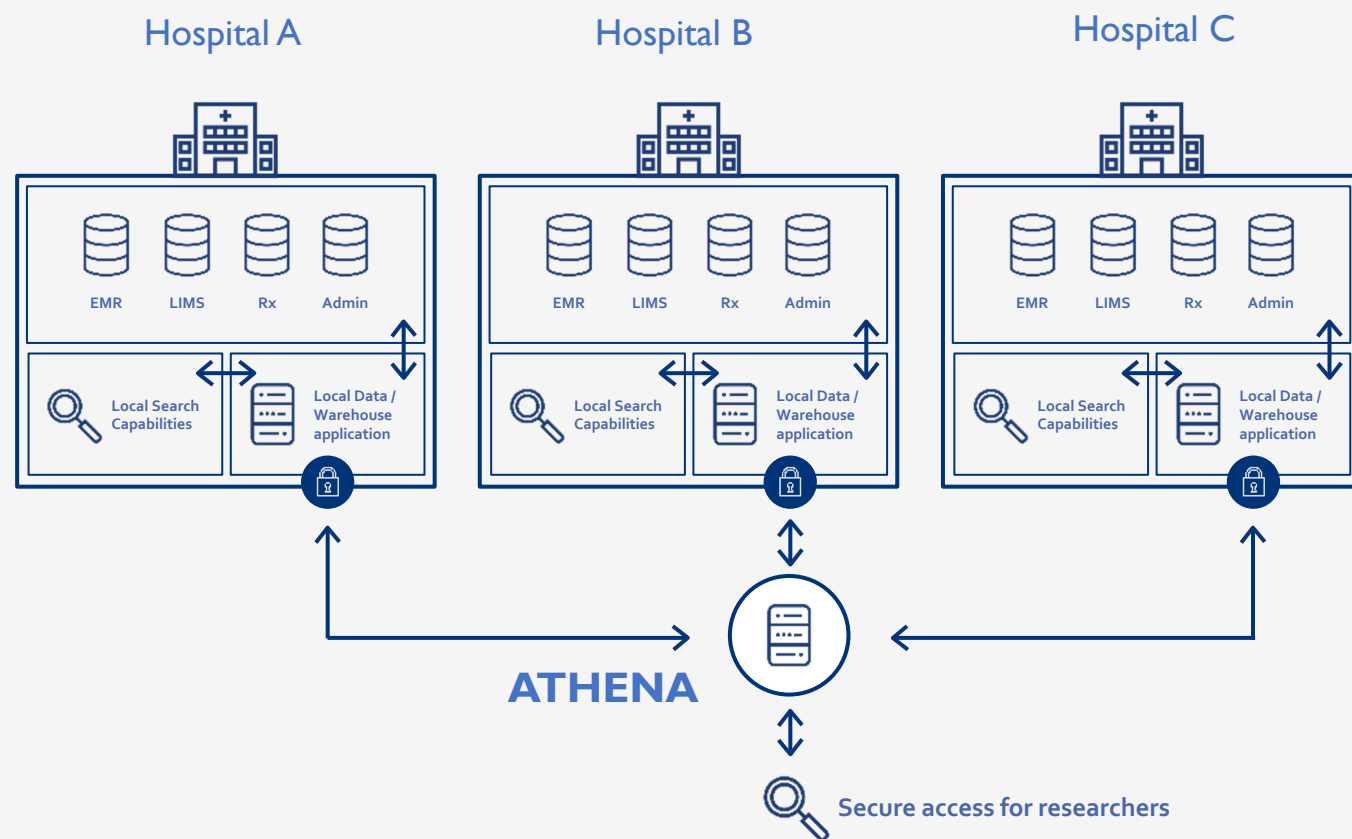
Perform federated analytics across hospitals

Only derived information is shared between partners



Federated analytics only share derived model information, e.g. feature vectors, summary statistics, ...

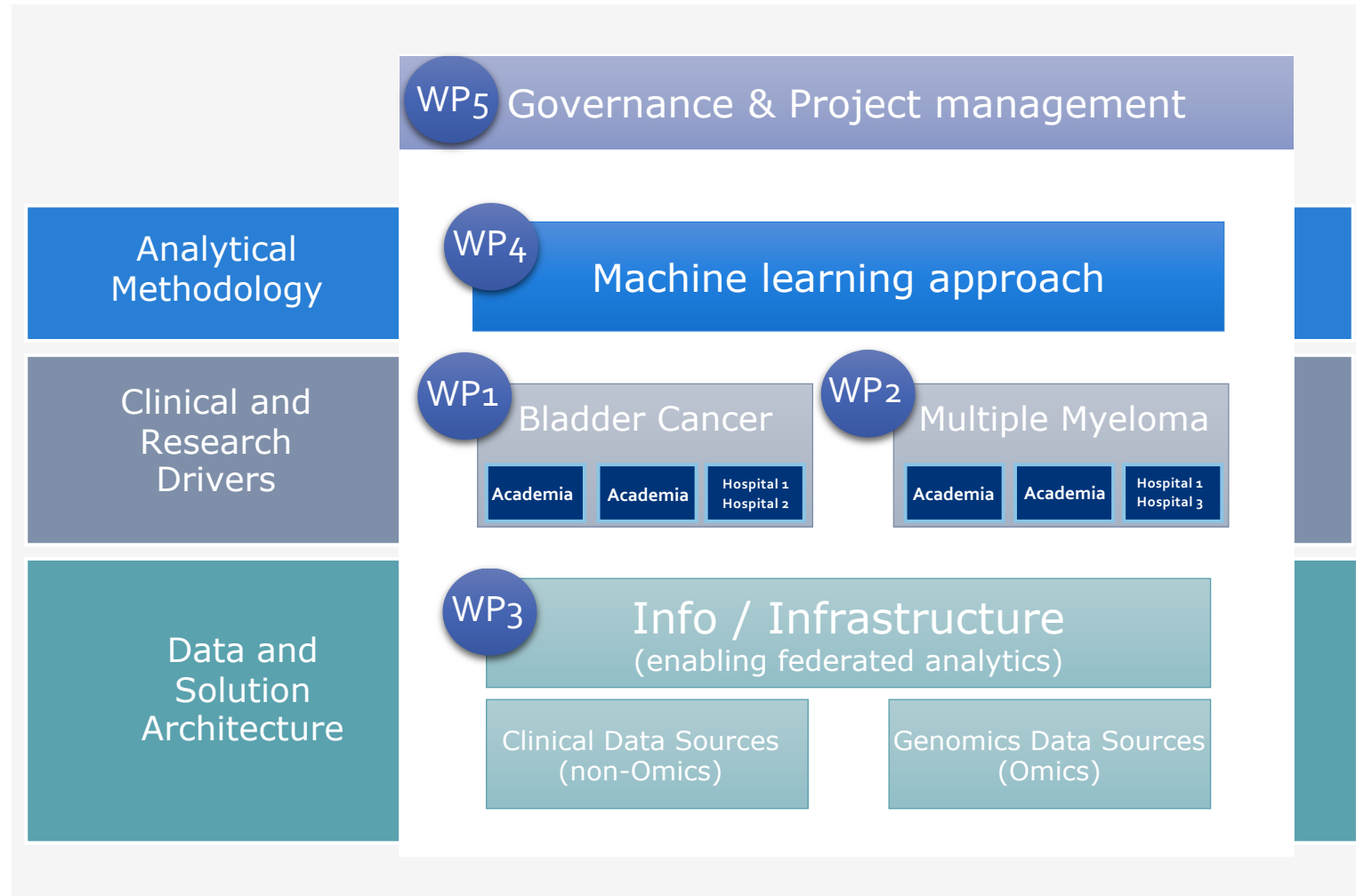
ATHENA's privacy-preserving federated ML platform



- Data remains under the control of the data owner
- No patient level data leaves the owner's site, only aggregated counts, thereby ensuring patient privacy
- **GDPR – 'Privacy by Design'**
- Analyses are brought to the data, rather than creating central data repository
- Use of common data model allows for efficient search/analyses across multiple data sets
- Local legal and ethical approvals
- Requires close collaboration with data owners which builds trust

Federated and privacy-preserving architecture

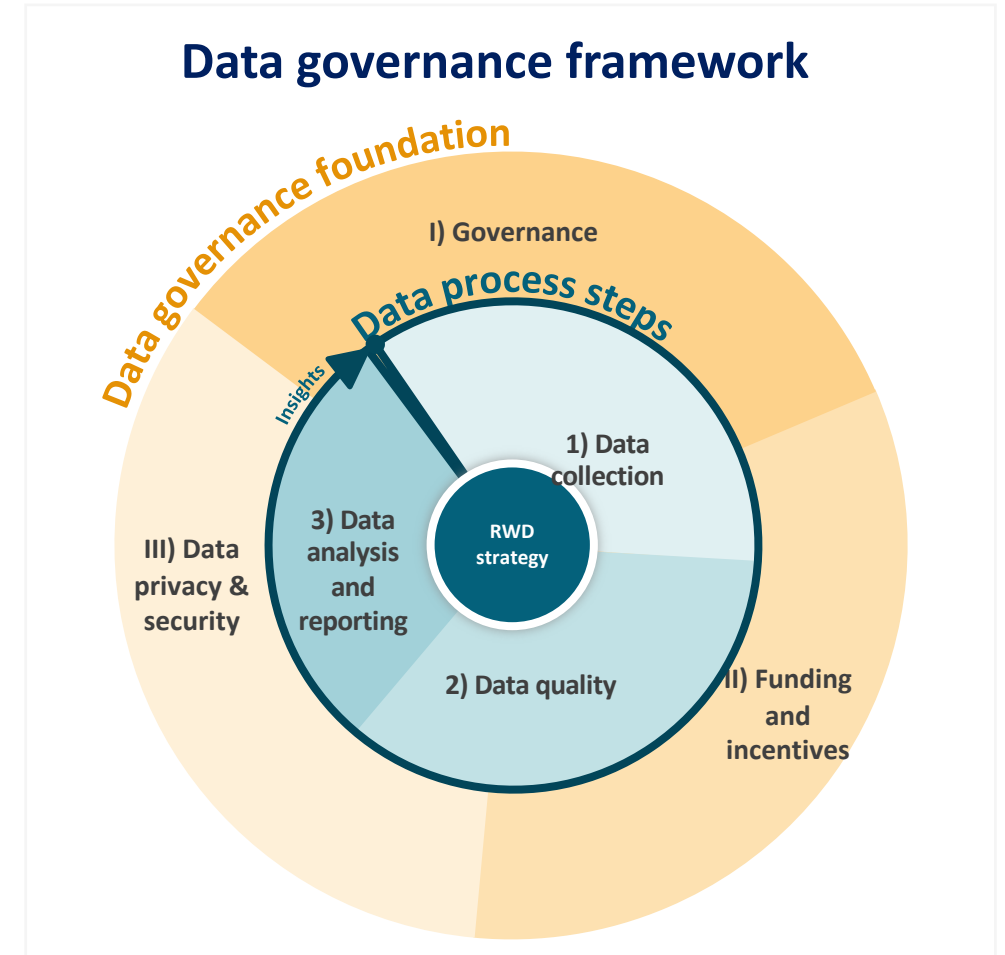
Joining forces to advance personalized medicine through privacy-preserving federated ML



Scalability and future of ATHENA

Creating the opportunity for wide scale deployment across multiple institutes, multiple disease areas and multiple geographical regions

- ATHENA acts as an innovation incubator, incorporating multiple hospitals to address platform scalability
- Extensions to other disease area and regions
- Data access and management strategies
- **Data governance model** and application
- Legal, ethical, IP framework for the project



Envisioned impact of ATHENA

- **Utilize leading-edge technology**, integrated and enriched patient level data and analytics
- Leverage machine learning to generate insights from **EHR, genomics and medical imaging data**
- Addressing barriers to precision medicine adoption such as **ethics, consent and data governance, data quality and interoperability and affordability**
- Support coordination and strengthening of **research, academia and industry partnerships**
- Stakeholder engagement to establish effective funding mechanisms (incl. reimbursement), regulatory frameworks and policy, as a **basis for value-based healthcare**

