



# The future proof Clinical Data Repository

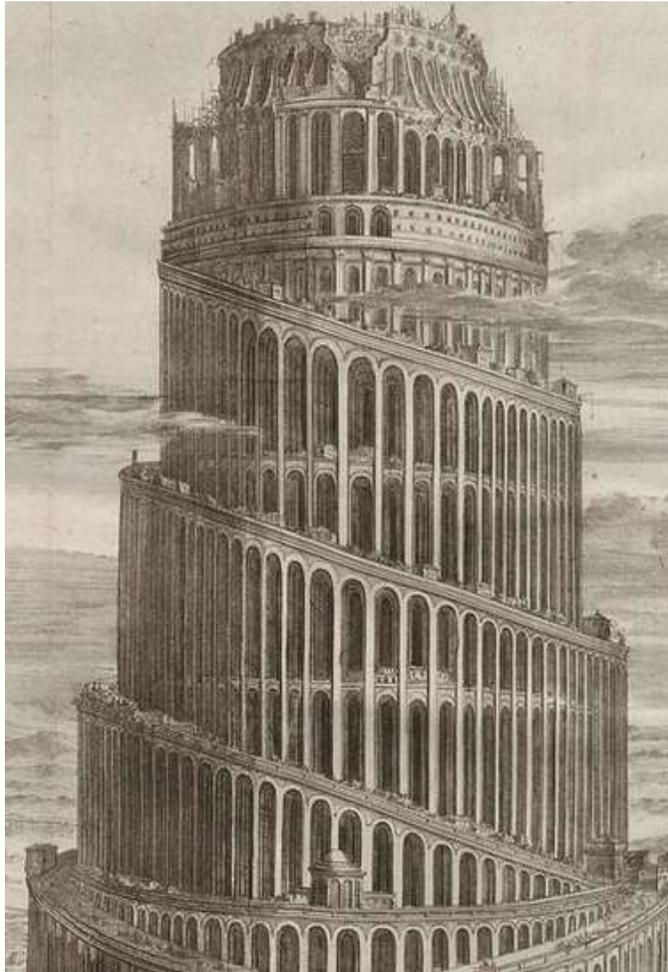
Bridging the gap between openEHR, FHIR and OMOP

**Severin Kohler**

31.01.25 Berlin

Image source: Star Trek: The Next Generation, CBS Studios

**Someone built this**



**and now I have to  
study 5 standards**

A dark, atmospheric painting of a graveyard at night. In the center, a large, dark, multi-story building with a prominent window stands amidst a dense forest of bare, gnarled trees. The ground is dark and uneven, with several tombstones and a cross visible in the foreground. The sky is a mix of dark grey and muted yellow-green, with a small crescent moon in the upper right. The overall mood is somber and mysterious.

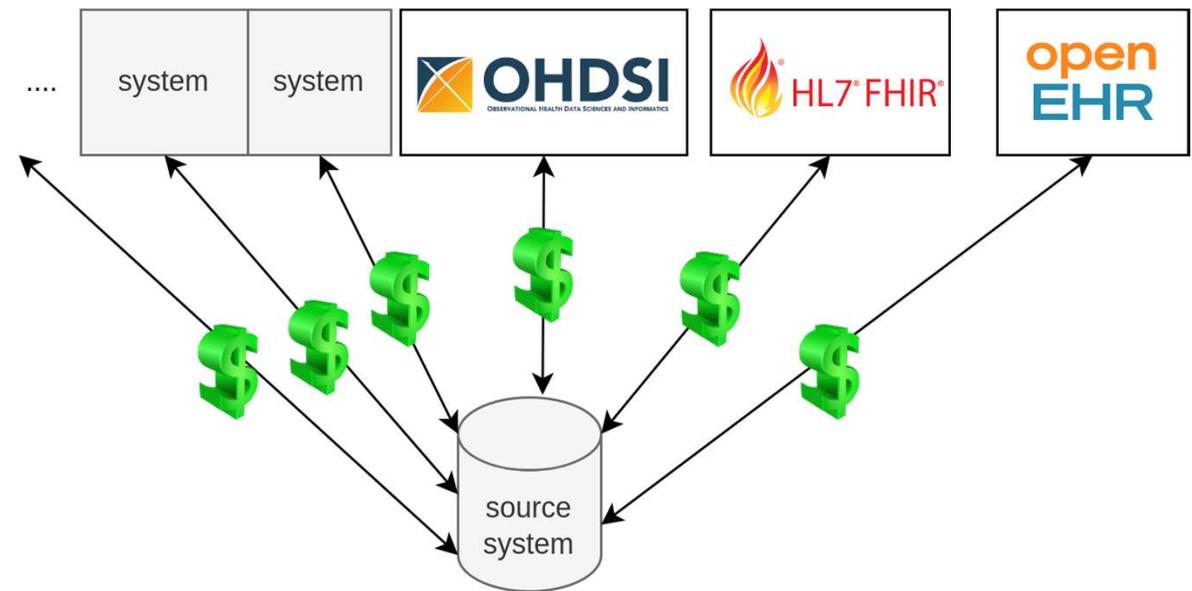
# Problem

# Integration

- **Electronic Health Records (EHR)** have a **heterogenous structure and semantics**
- making **integration** a major **barrier** in **health informatics**
  - **paywall (silo)**
- **interoperability** tries to **solve** that

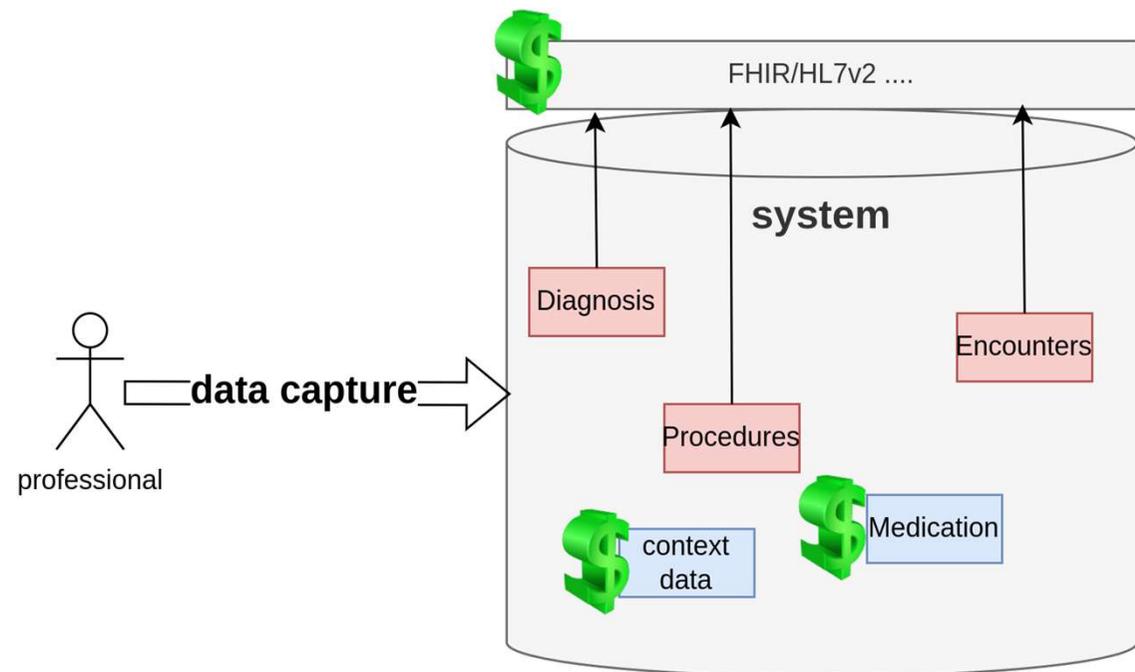
# Extract Transform Load (ETL)

- **integration** process to a proprietary or **standardized** format
- **expensive, resource-intensive**
- varies **depending** on the **scope**
- **limits** also the **data shared**



# Interfaces

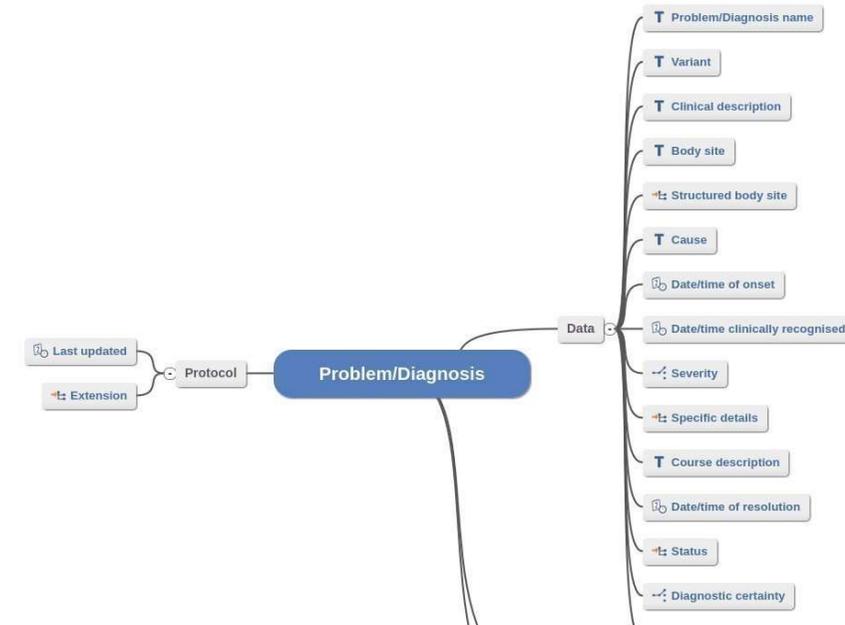
- the **last decades** we **tried** to **solve** that by **applying interfaces**
- **vendors** are **more flexible**, **provide** some of the **information via** an **API**
- **faster adaptation**
- **problem:**
  - **symptom treatment**
  - **nit-picking information**
  - paying **recurring fees** for each **interface**



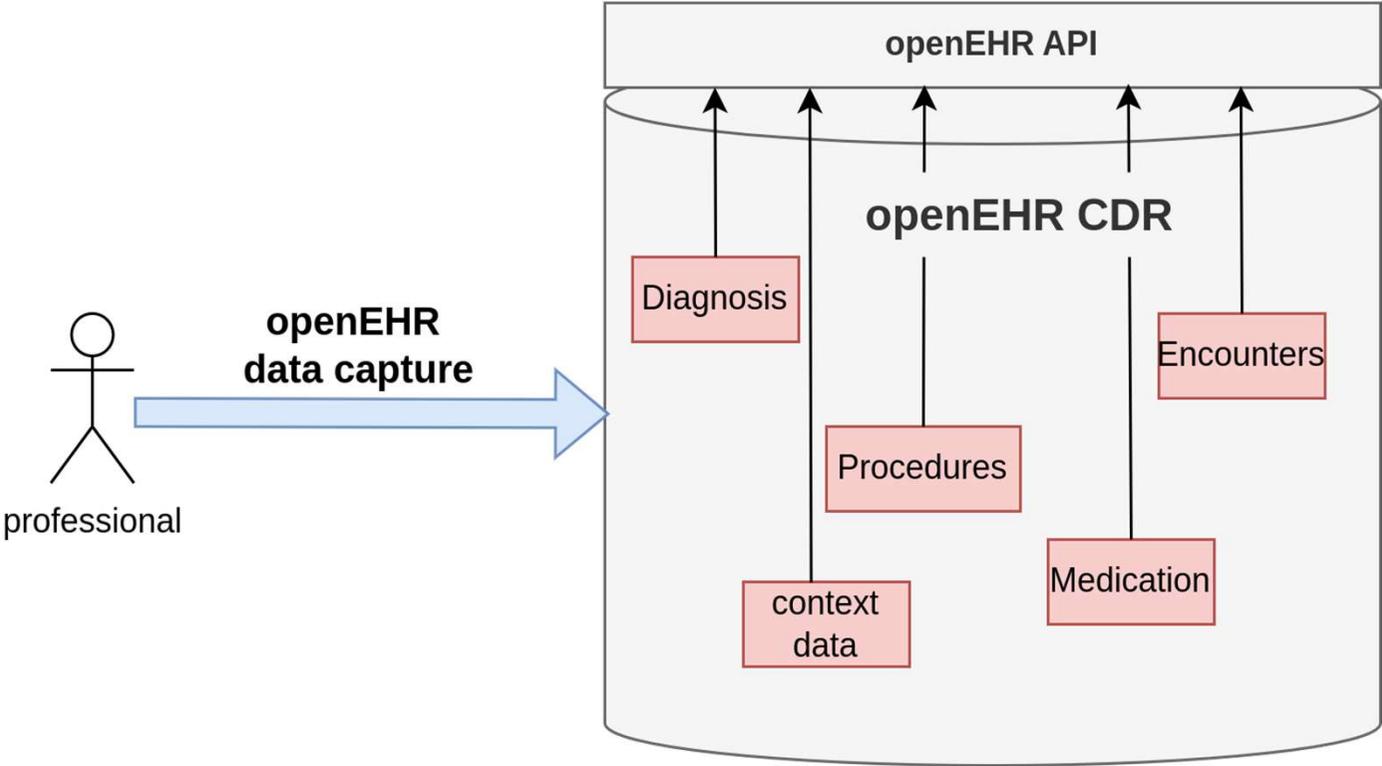
# openEHR



- aims to **standardize** an **EHR**
- excels for standardization **at point of capture**
- **international models** (archetypes) cover more than **rudimentary data**
- aim to **represent** as much **data** as **possible** (inclusive)
- **federation** (HiGHmed)



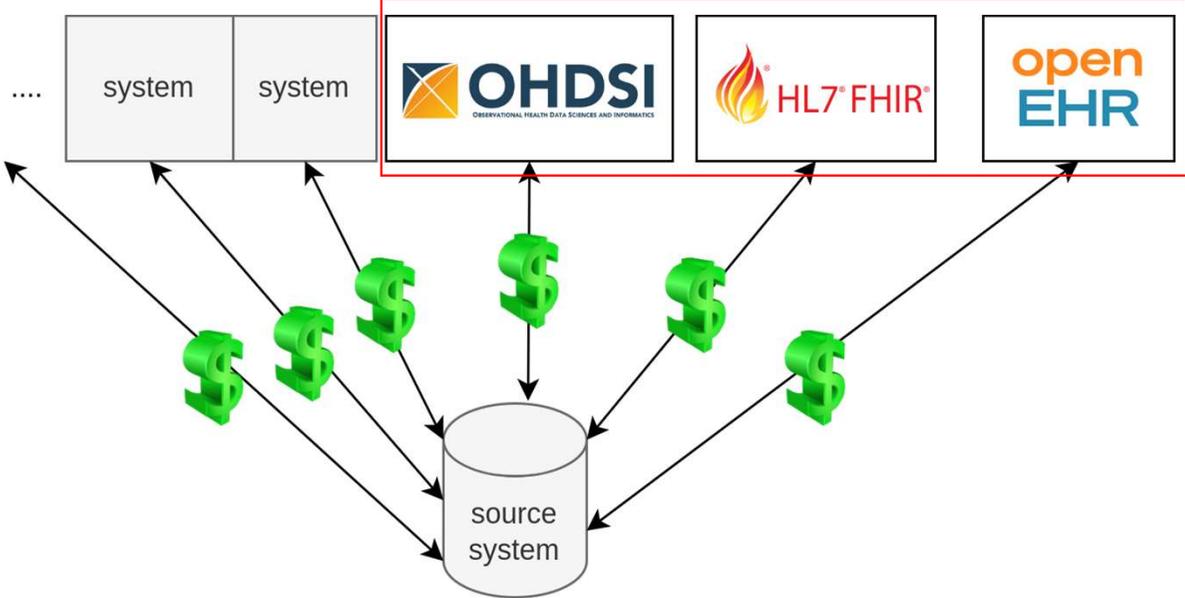
# Standardizing on the point-of-capture

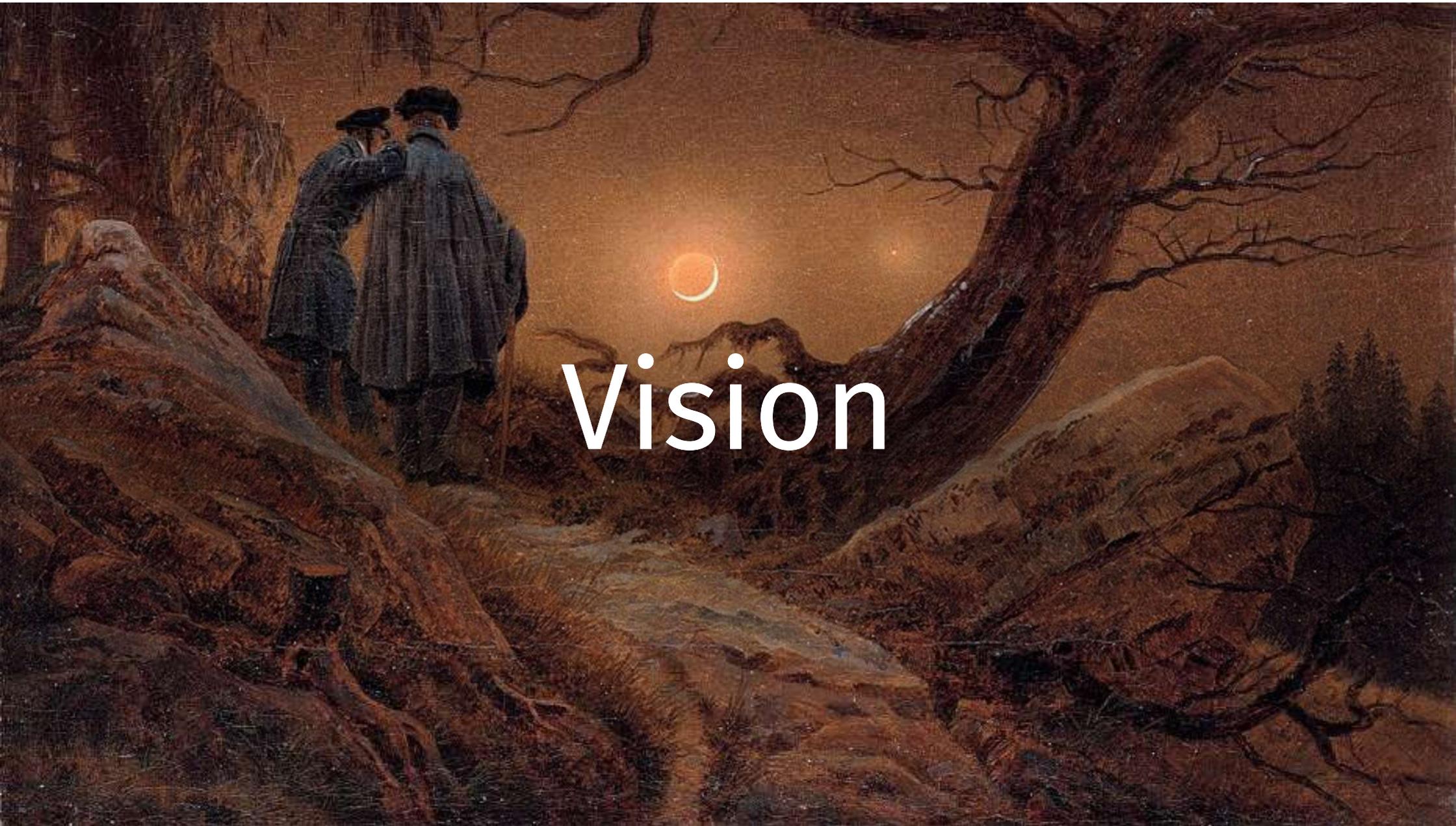


# Problem

- **high barrier of adaptation**
  - **complexity**
  - **paradigm change**
- **reality is: not everyone will support openEHR, FHIR, OMOP ...**

# Standardized to Standardized



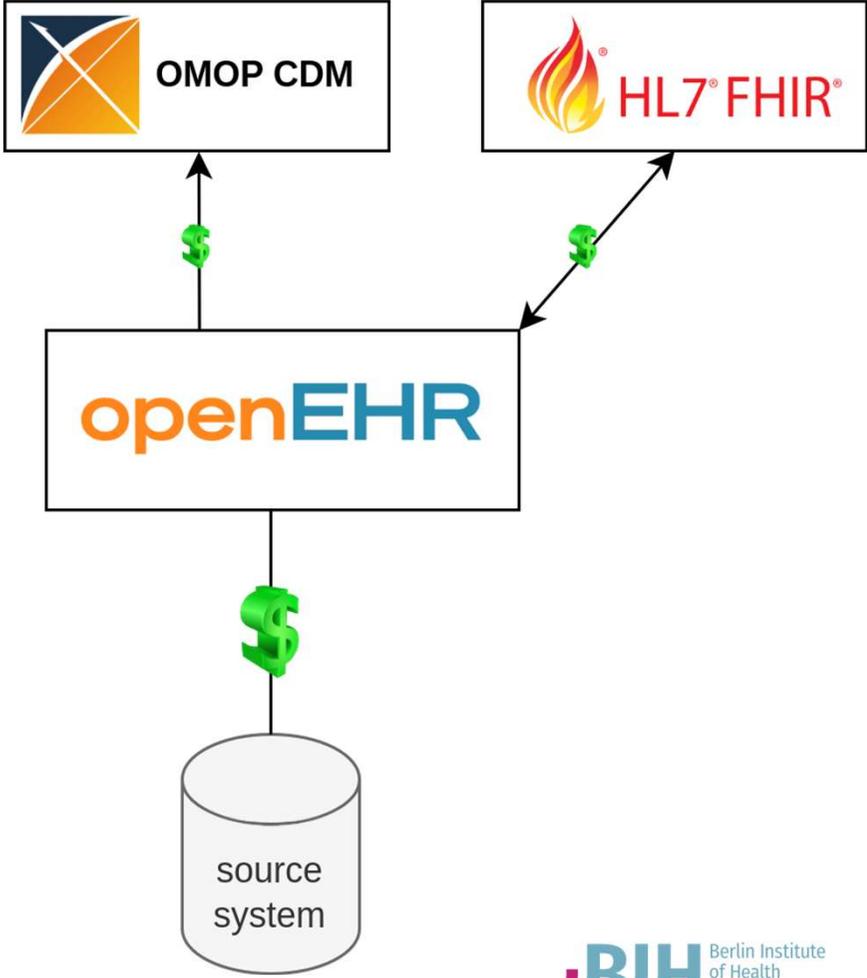
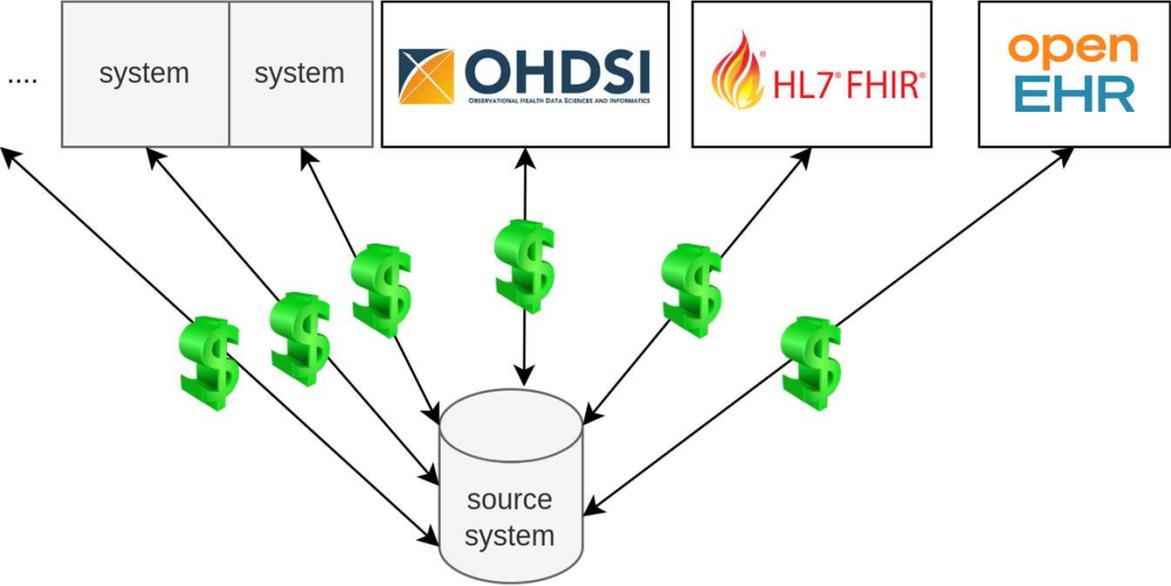


Vision

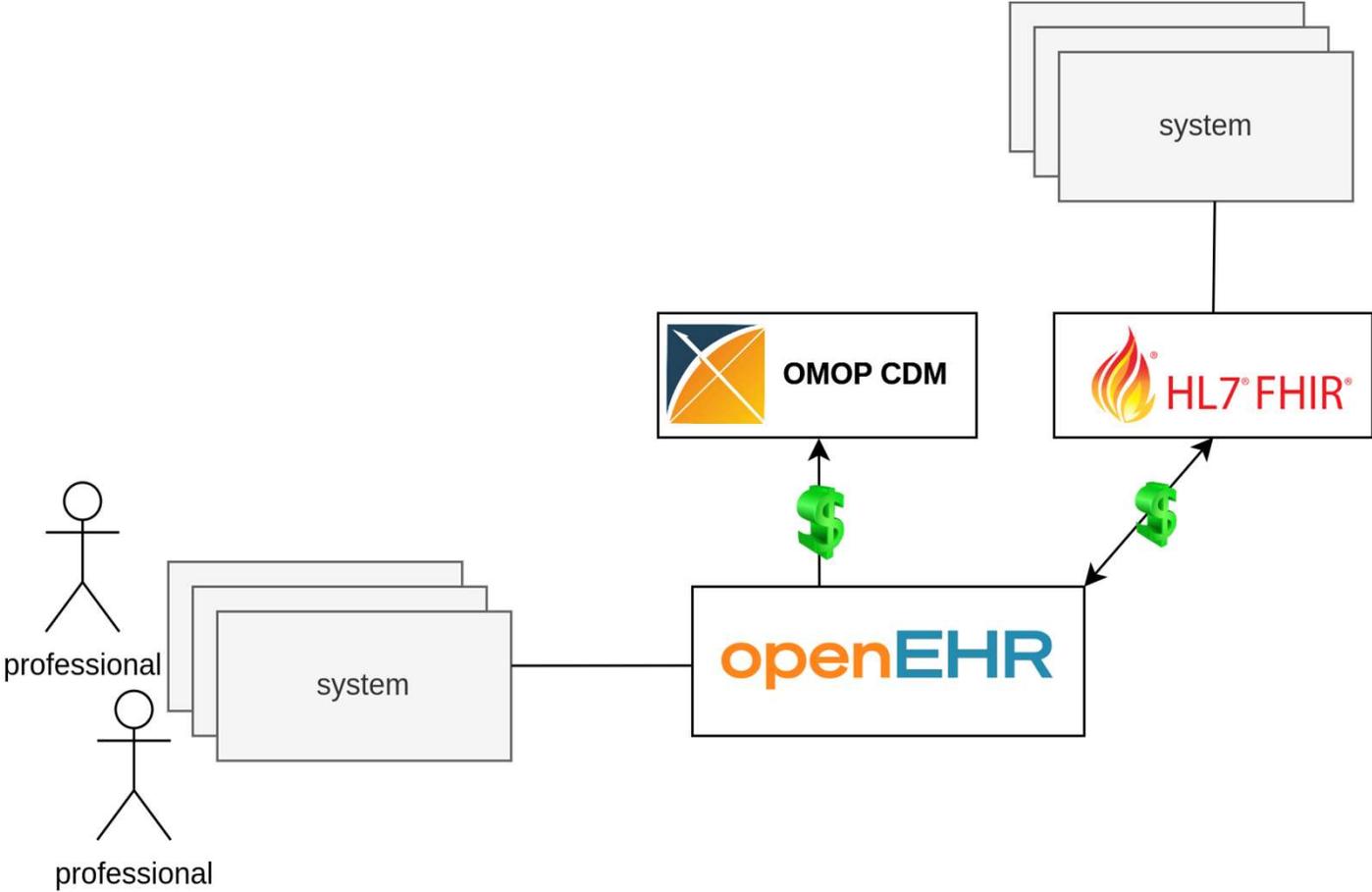
# Automatic integration between standards

- **definition of ETLs between standards promises to save resources**
- **high semantic richness**
- **international models** enable the **definition of mappings** for all **openEHR institutions** (international archetypes)
- **difficult to agree on semantic interpretation**
  - **openEHR improves the consistency of FHIR and OMOP CDMs**

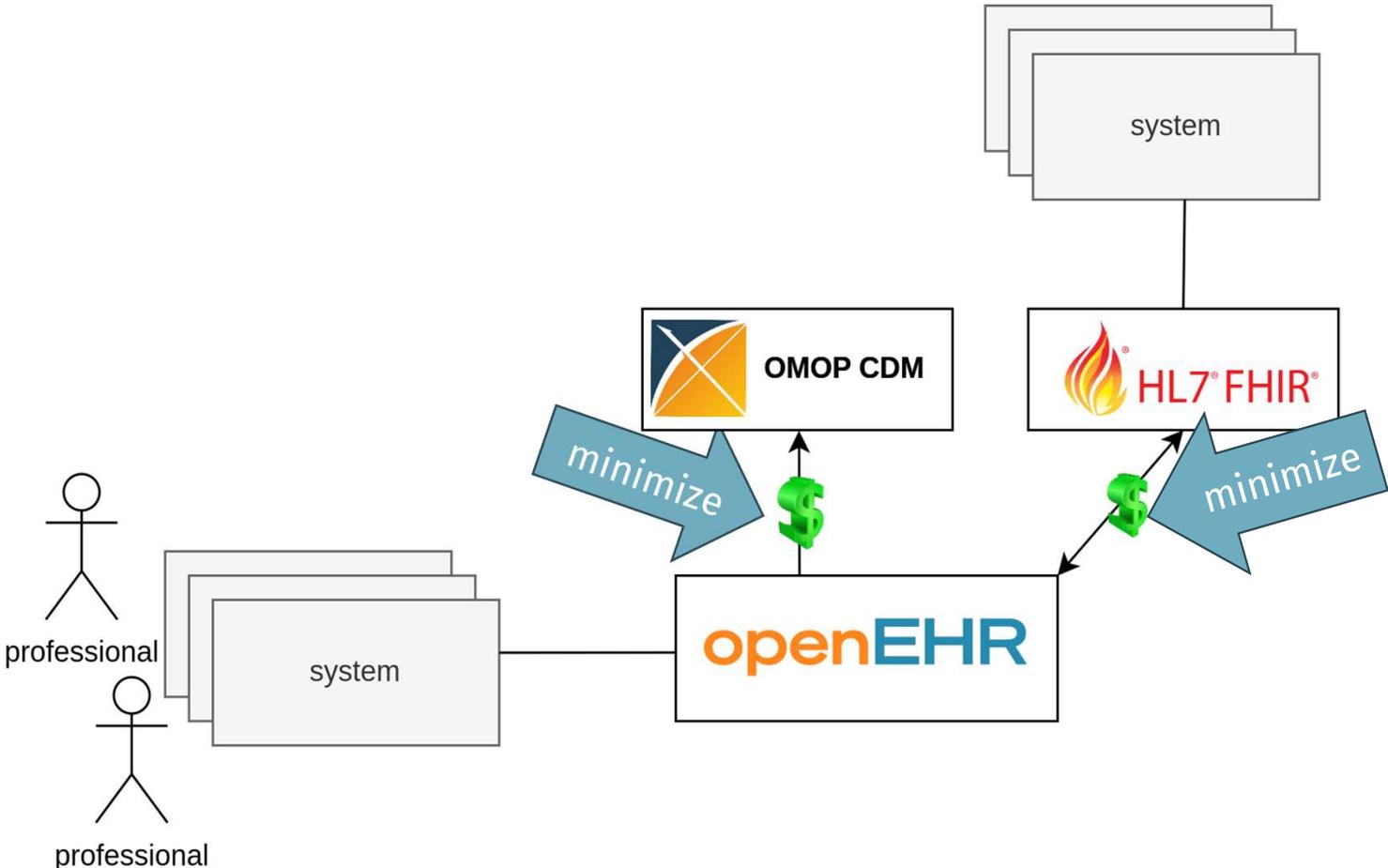
# The idea



# Combined ....



# How do we minimize cost?



A painting of ancient ruins on a hillside at sunset. The scene is dominated by a long, dark stone wall with several tall, rectangular columns. The sun is a bright yellow orb on the left side of the sky, casting a warm, golden glow over the landscape. The sky is a mix of orange, yellow, and purple. The foreground shows a stone wall and a path leading up to the ruins. The overall mood is serene and historical.

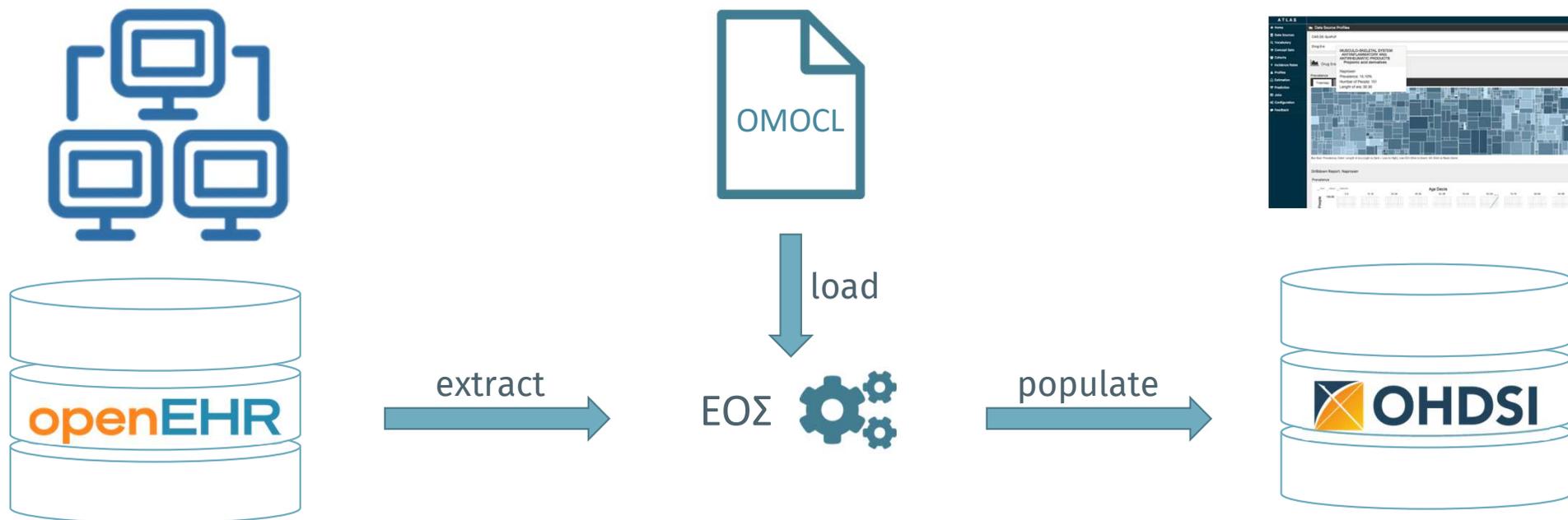
# Eos & OMOCL

# OMOP Common Data Model (CDM)



- used to **harmonize data** from EHRs for secondary use
- maintained by **OHDSI**
- proposes a **generic database** and **vocabularies** model to **facilitate clinical research**
- it provides a **multitude of tools** to exploit the research repository
  - **very popular:**
    - => More than **100 healthcare databases** from over 20 countries
    - => More than one **billion** patient records

# Eos



# Outcome



Veratech

- **release** in the **upcoming weeks**
  - with **veratech for health**
- transforms **all data stored** in **184 international archetypes** to **OMOP CDM**
  - works **out of the box**
  - all **openEHR platforms** now **support OMOP**
- **tooling** and **engine** is **open source**

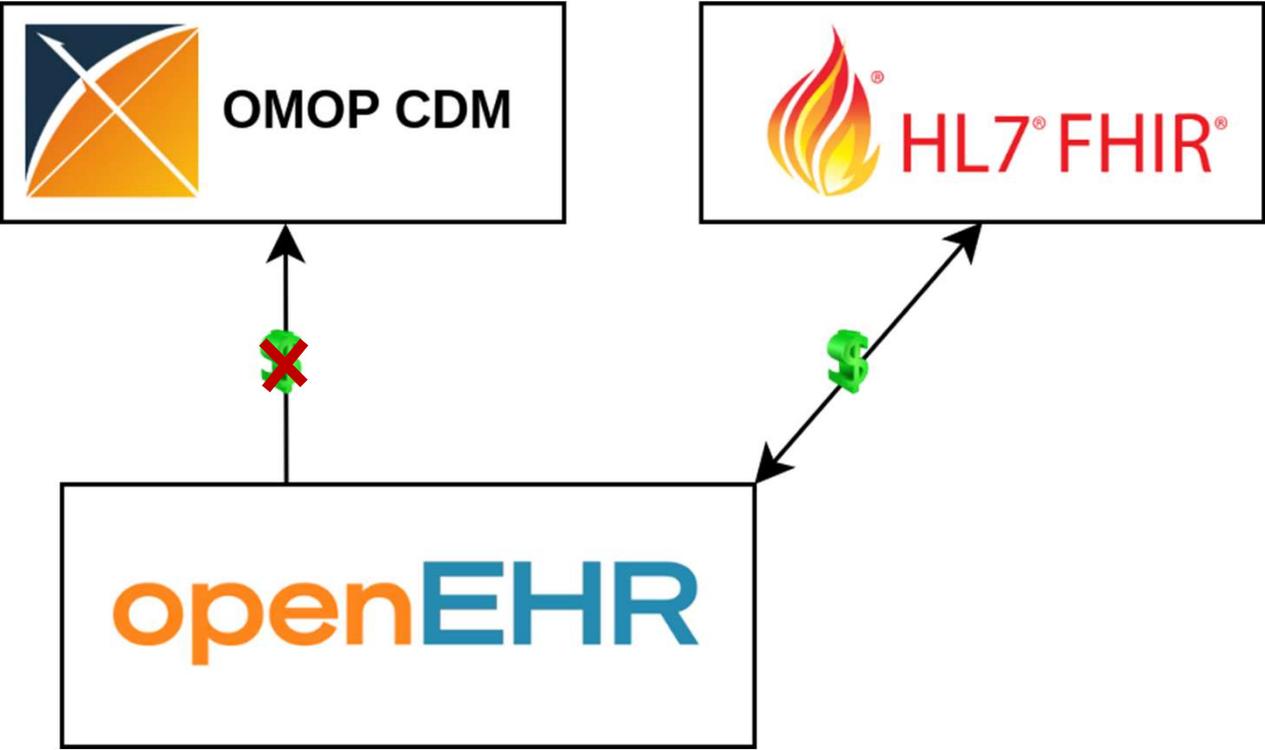
<https://github.com/SevKohler/OMOCL>

<https://github.com/SevKohler/Eos>



**HiGHmed**  
Medical Informatics

# Result

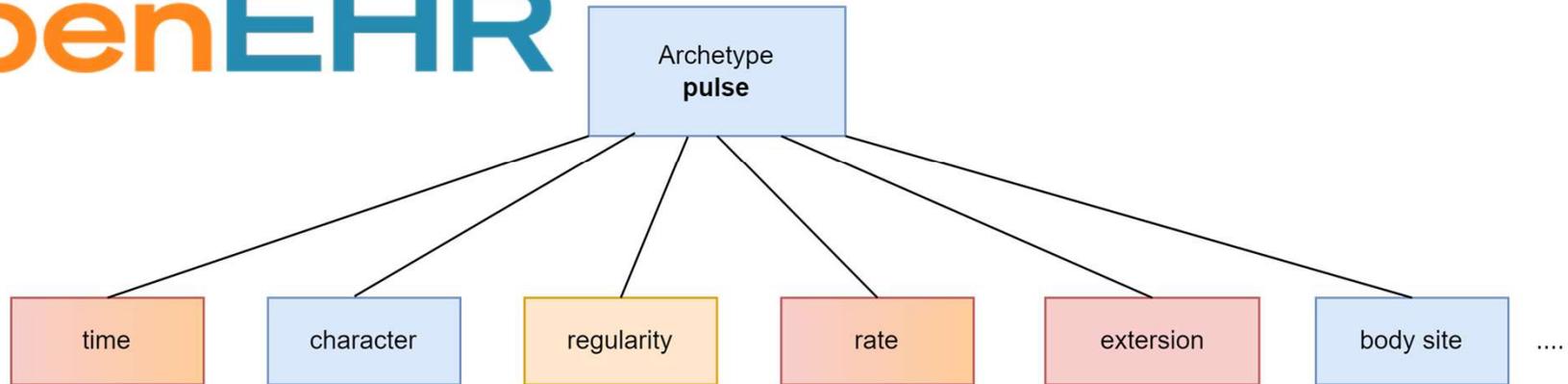
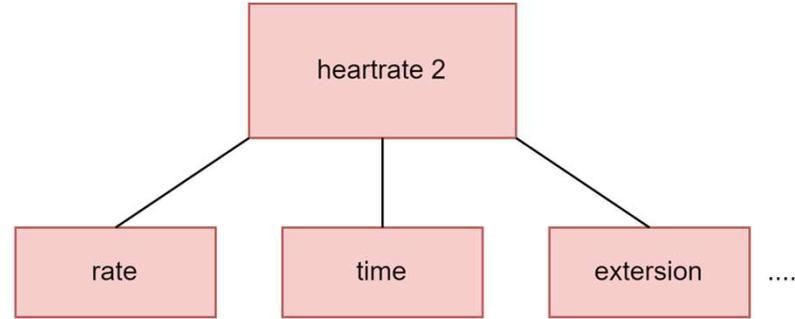
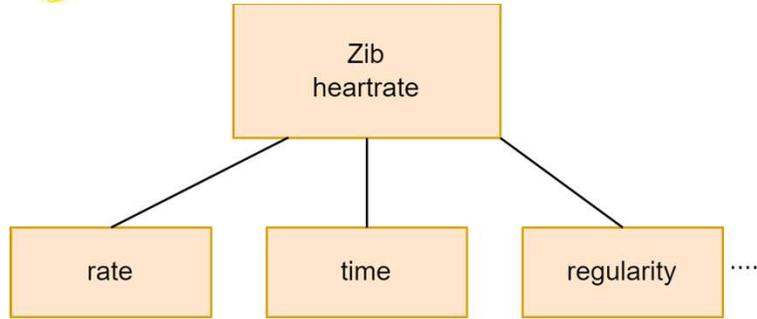




FHIRconnect

# Fast Healthcare Interoperability Resources (FHIR)

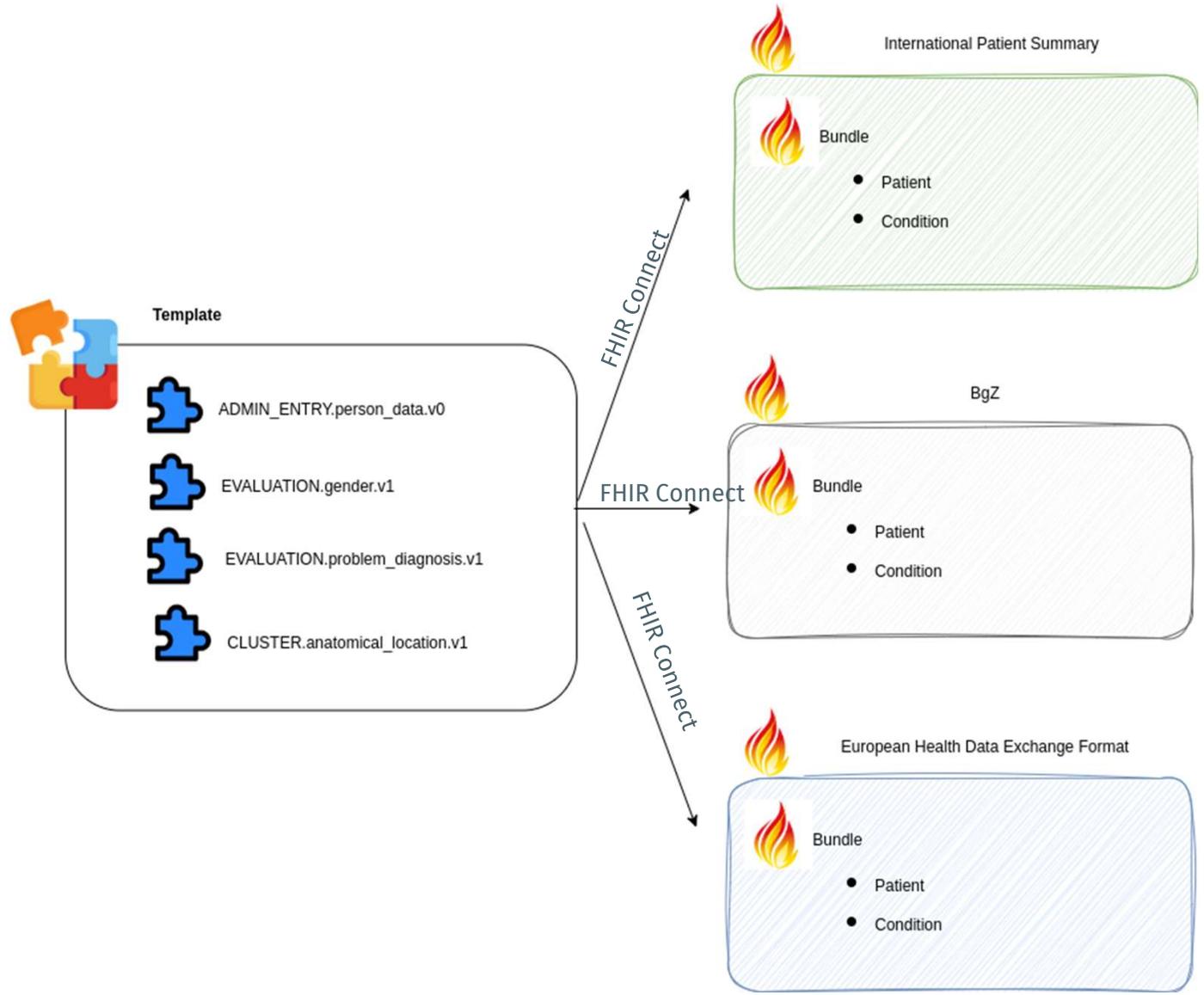
- defined by **HL7**
- **used to standardize data exchange of systems**
- **defines a generic data model**, so called "**resources**"
- these are **extended** using **profiles** for the **specific** use-cases
- **leads to interoperability problems**
  - each **implementation** and **initiative** defines their **own extensions**
- **65/35<sup>1</sup>, 35% of elements are added**
- **FHIR != FHIR**



# FHIRconnect & FHIRBridge

- **HiGHmed e.V., Medblocks, Gasper Andrejc** ([www.open-fhir.com](http://www.open-fhir.com))
- **specification is open source** and it's not a **commercial product**
- **mappings are bidirectional**, you **write** a single **mapping** and it **maps** from **FHIR to openEHR** and from **openEHR to FHIR**
- **specification is vendor agnostic** and **not tied** to any **FHIR server** or any **openEHR CDR**
- **reusable mappings, modular, inheritance & extendibility, sustainable**





# Mappings as part of the model

The screenshot shows the openEHR Clinical Knowledge Manager interface. The top navigation bar includes 'Archetypes', 'Templates', 'Termsets', 'Release Sets', 'Projects', 'Reports', and 'Help'. The main content area is titled 'Blood pressure' and shows a 'LATEST REVISION / LATEST PUBLISHED | 10 [2.0.9]' status. The 'Mappings & Queries' section is expanded, showing four categories: 'FHIR® Mapping', 'OMOP Mapping', 'AQL', and 'Subset Model'. Each category has a description and a note that 'No documents have been uploaded yet.' Red arrows point to the 'FHIR® Mapping' section and the 'OMOP Mapping' section.

**openEHR Clinical Knowledge Manager**  
Powered by Ocean Health Systems

Username/Email Password  [Log In](#) [Forgot Your Password?](#) [Register](#)

Archetypes ▾ Templates ▾ Termsets ▾ Release Sets ▾ Projects ▾ Reports ▾ Help ▾

Dashboard Find Resources Blood pressure ×

**Blood pressure** LATEST REVISION / LATEST PUBLISHED | 10 [2.0.9] ✓

**Mappings & Queries**

**FHIR® Mapping**

FHIR® Mappings formally document mappings between models, i.e. from openEHR archetypes and templates to FHIR® resources, or contextual mappings to FHIR® artefacts such as resources, profiles, bundles, or implementation guides. Mappings can for example be expressed with 'FHIR Connect' or with mapping tables/spreadsheets. FHIR is the registered trademark of Health Level Seven International and the use does not constitute endorsement by HL7.

No documents have been uploaded yet.

**OMOP Mapping**

OMOP Mappings formally document mappings between models, i.e. from openEHR archetypes to the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM). Mappings can e.g. be defined using the declarative OMOP Conversion Language (OMOCL) or with mapping tables/spreadsheets.

No documents have been uploaded yet.

**AQL**

Queries expressed in openEHR's Archetype Query Language (AQL) are semantically based on the data structure defined in archetypes. They can be shared for consistency and to encourage their reuse.

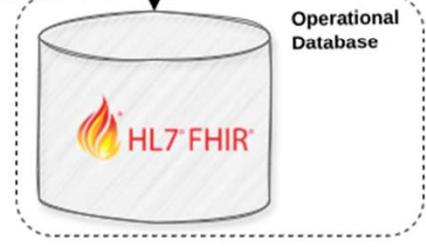
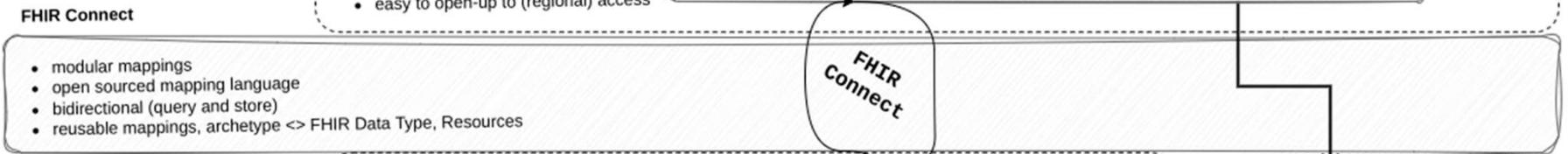
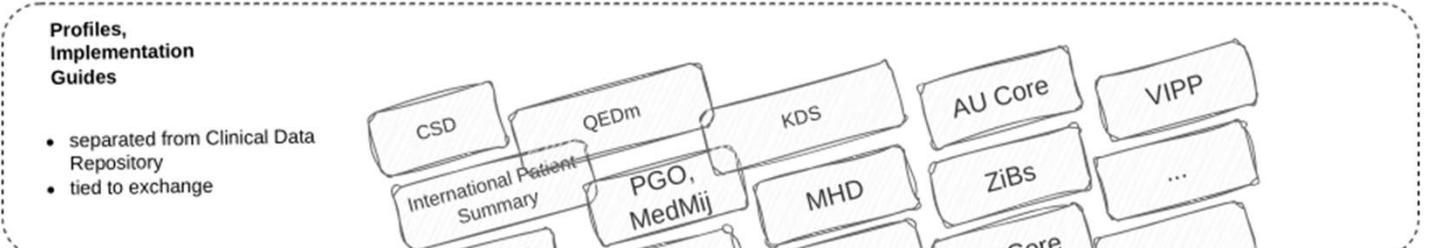
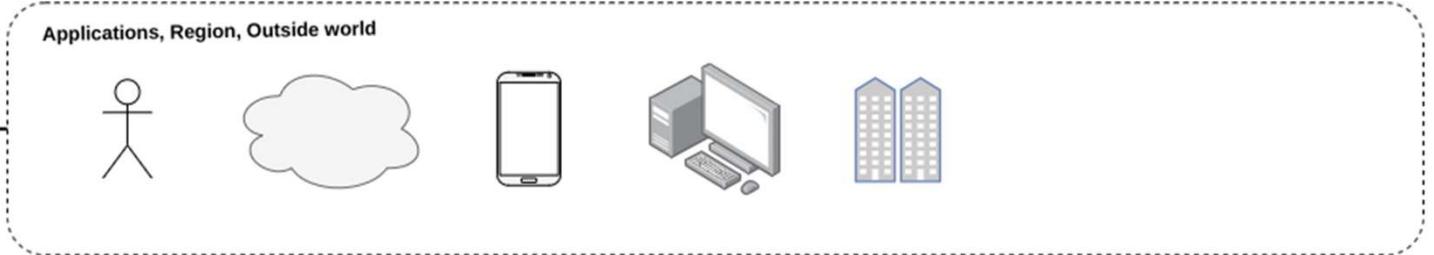
No documents have been uploaded yet.

**Subset Model**

Subset models showcase subsets of archetypes that directly correspond to another model in another approach/formalism. For example, if only some elements of an archetype designed as a maximum dataset can be mapped to a FHIR® resource, this subset model or subset archetype would be stripped down to only contain these directly mappable elements while guaranteed to be consistent with the (maximum dataset) archetype.

No documents have been uploaded yet.

Exchange  
 • for openEHR systems  
**openEHR**



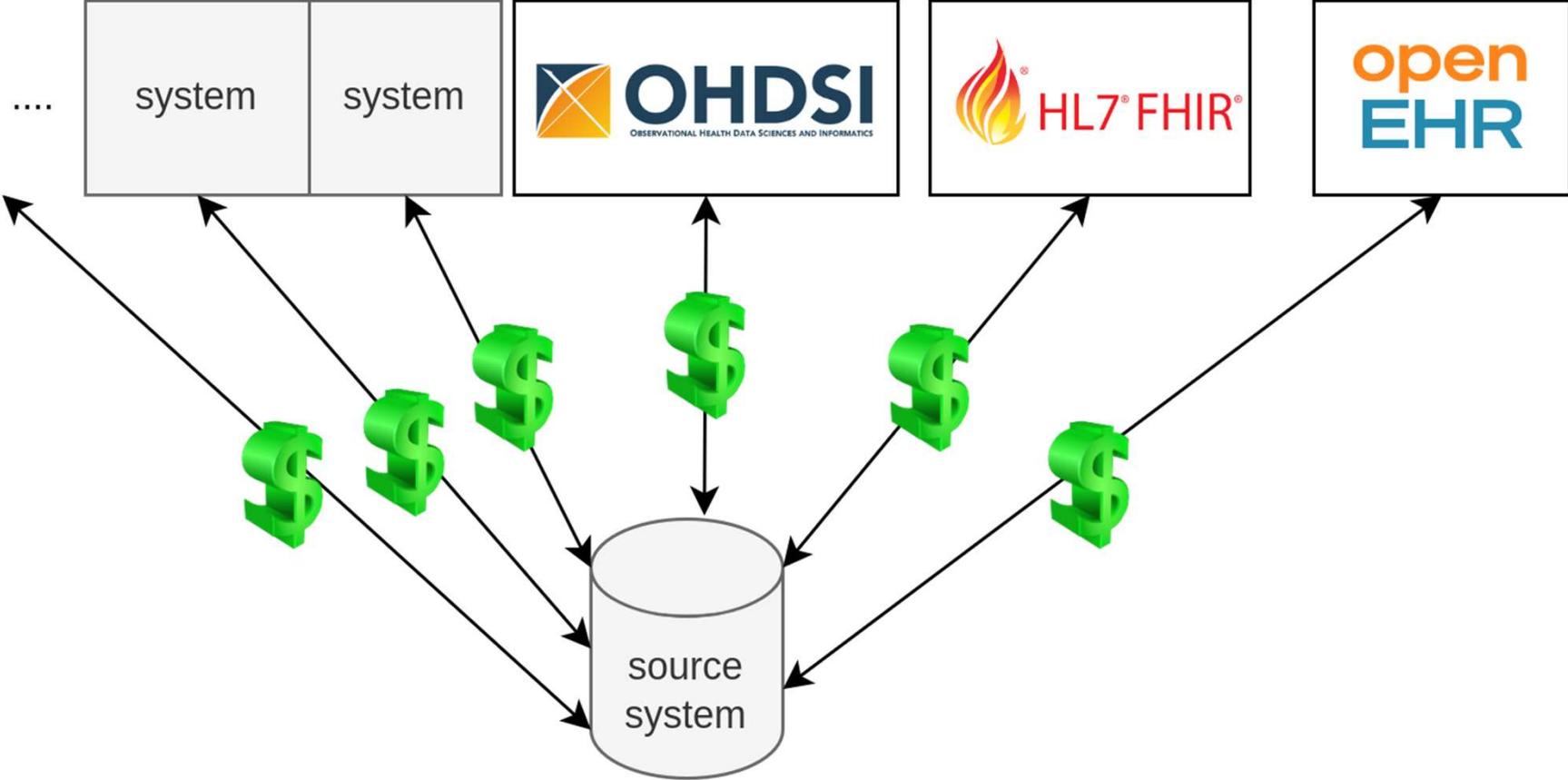
INNOVATION  
 EXCHANGE  
 PERSISTENCE

# Conclusion

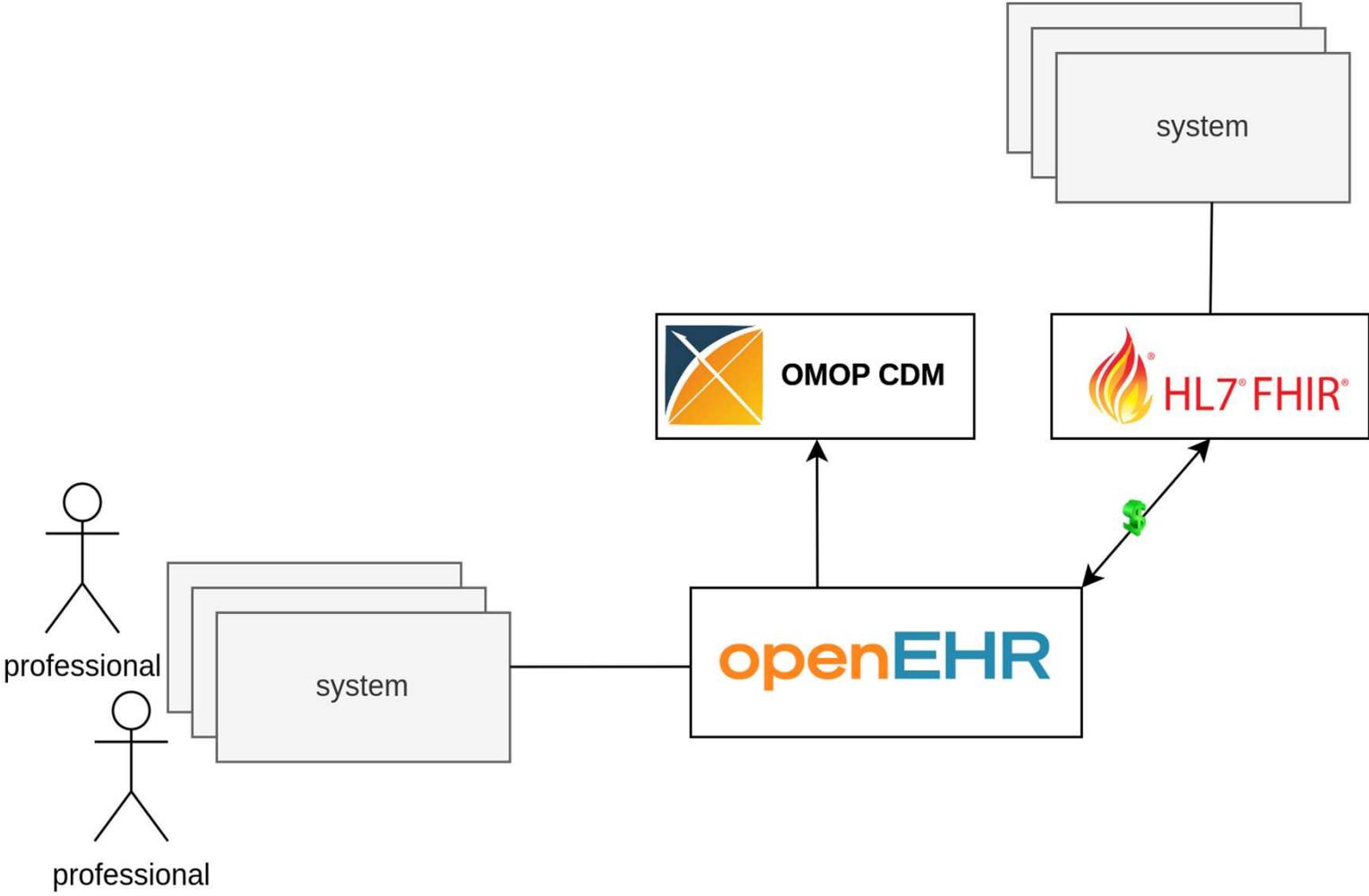
- **streamlines mappings**
- **minimizes costs, eases adaptation of standards and initiatives**
- **makes parts of the ETLs a community effort**
- **independent**
- **sustainable & future proof**



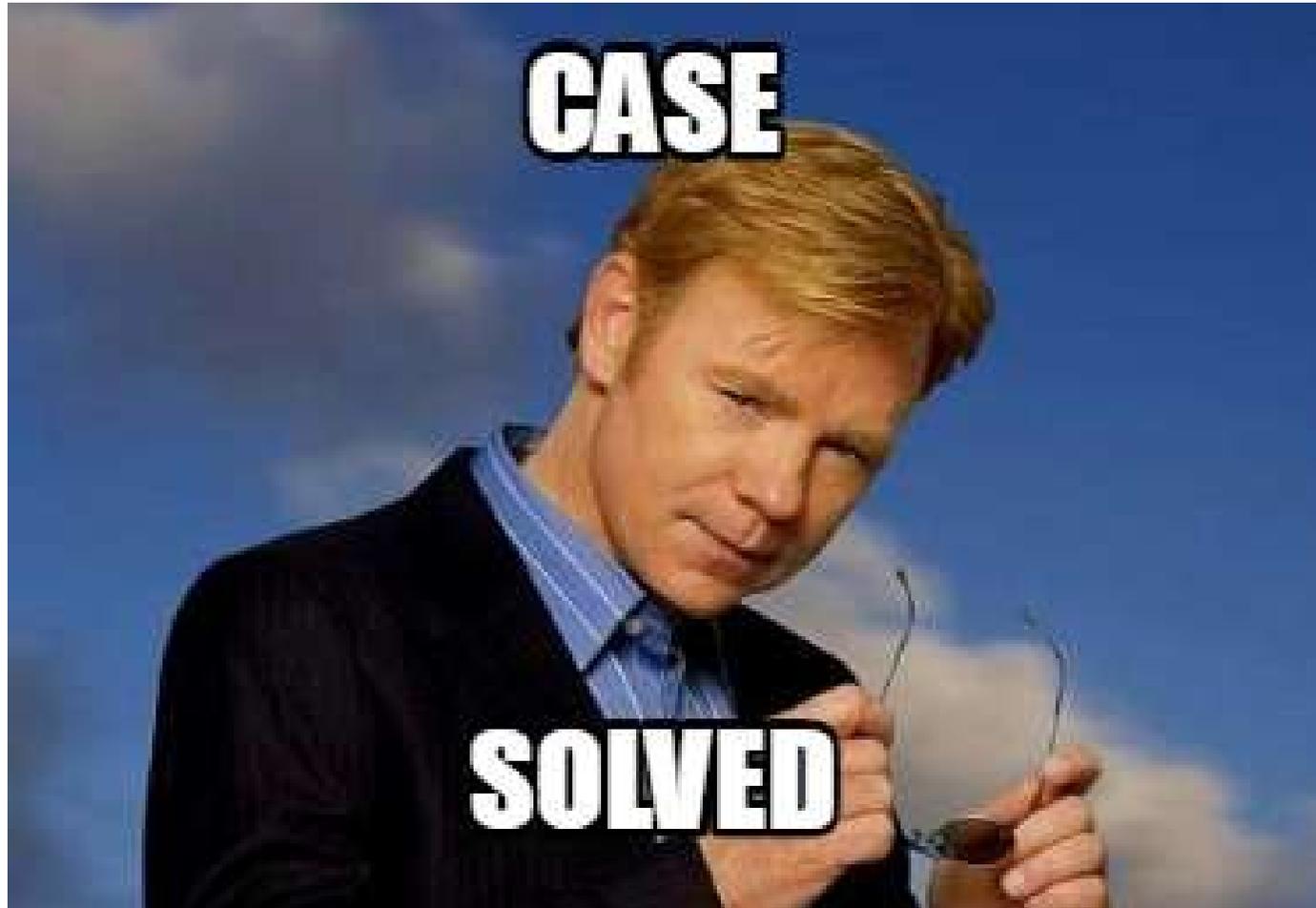
# Before

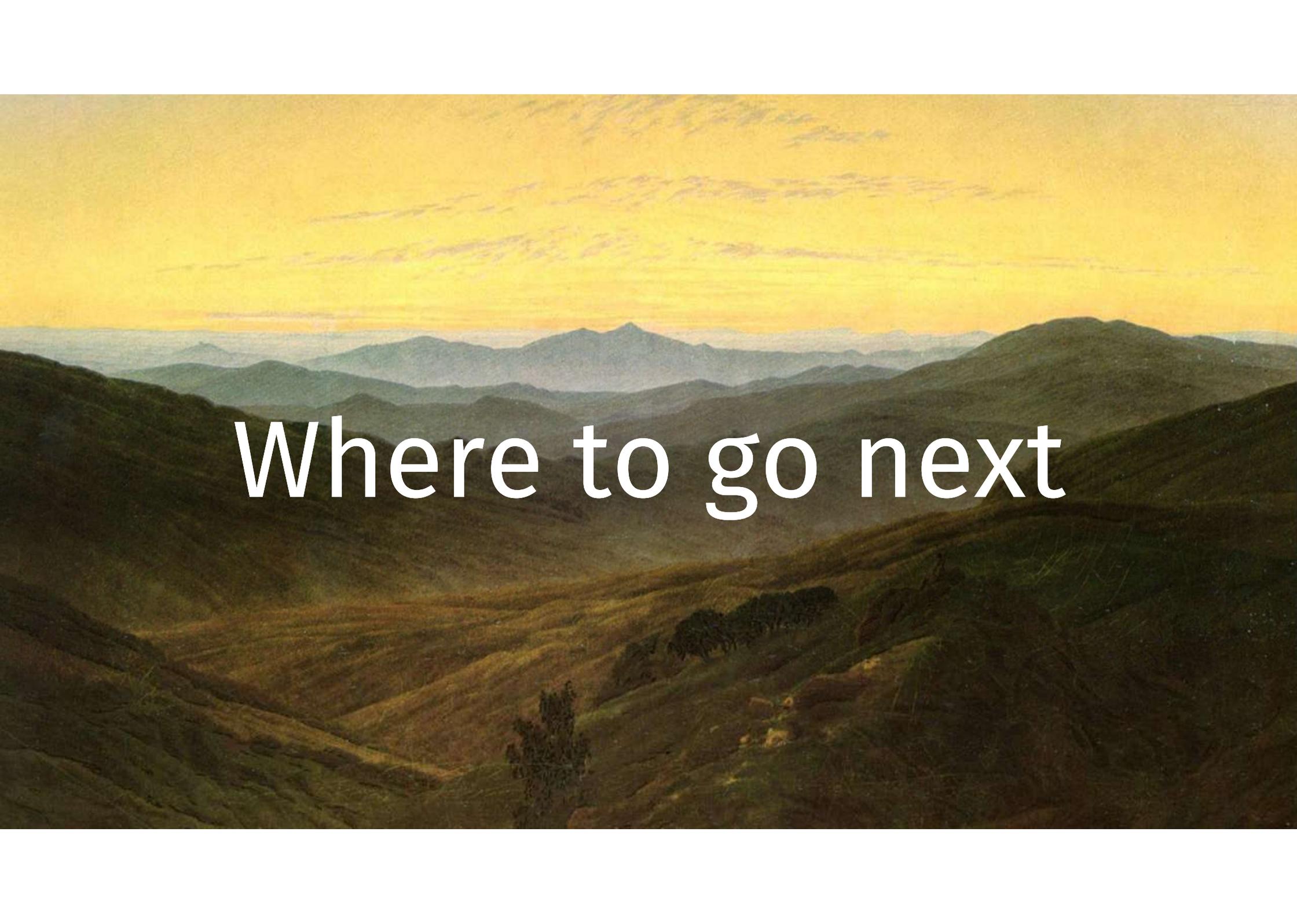


# Result



# Interoperability



A landscape painting of rolling hills at sunset or sunrise. The sky is a warm, golden yellow with soft, wispy clouds. The hills are layered, with the foreground in dark green and brown, and the background in a hazy, light blue. The text "Where to go next" is overlaid in the center in a white, sans-serif font.

Where to go next

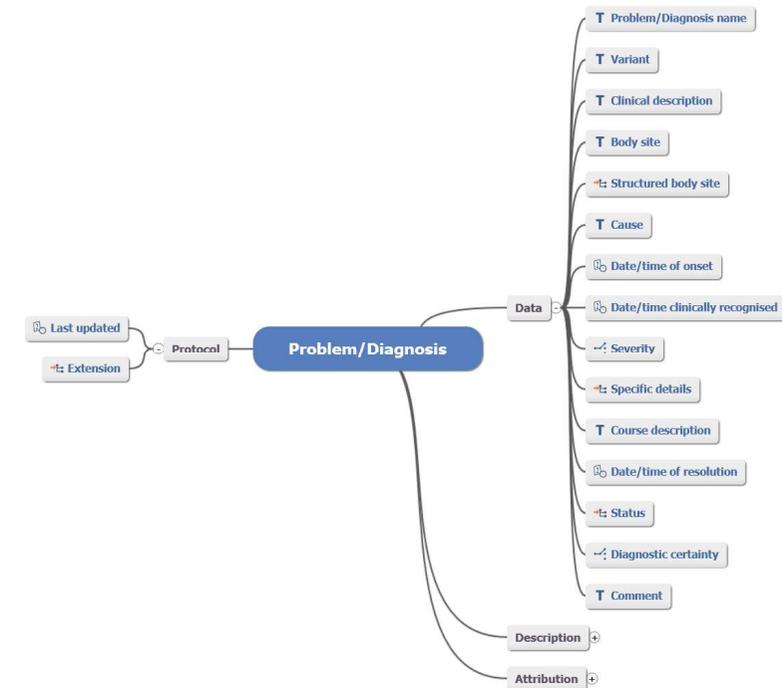
# Federation

- **same model = same data**
- **AQL**
- **European EHR** is mostly a matter of **connecting openEHR** platforms
  - for those who **support** it
  - **research** has a lot of **use-cases**
- **European EHR network**
- **kick off next month**



# AI

- **downstream interoperability is expensive (ETLs)**
- **value for AI ?**
- **LLMs can interpreted unstandardized data**
- **cheaper, more information** (cause of no **nit-picking**)
- one more argument for **standardized data-capture**
- inclusive **data** models as **openEHR**
  - contains **much more** as you usually **record**
  - **AI loves data :)**



# Thank you !

Special thanks to: Roland Eils, HiGHmed e.V., Dirk Meyer zu Büschenfelde, Erik Sundvall, Joshua Grisham, Ann-Sofie Stolperud, Rikard Lövström, Jordi Piera Jimenez, Xabier Michelena Vegas, Florian Kärcher, Andreas Kling, Erik Schneider, Gasper Andrejc ...

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