



# The future proof Clinical Data Repository

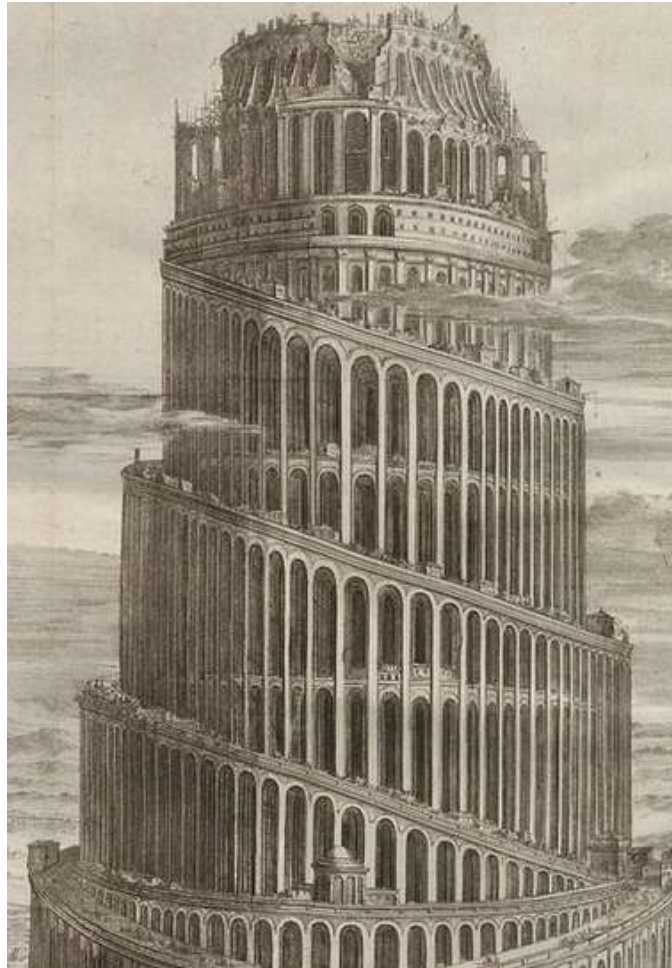
Bridging the gap between openEHR, FHIR and OMOP

**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, leafless tree stands prominently. Behind it, a building with a single, glowing window is visible. The foreground is filled with numerous small, dark tombstones and crosses. The sky is a mix of dark and light tones, with a small, bright, circular object (possibly a moon or a light source) visible in the upper right. The overall mood is somber and mysterious.

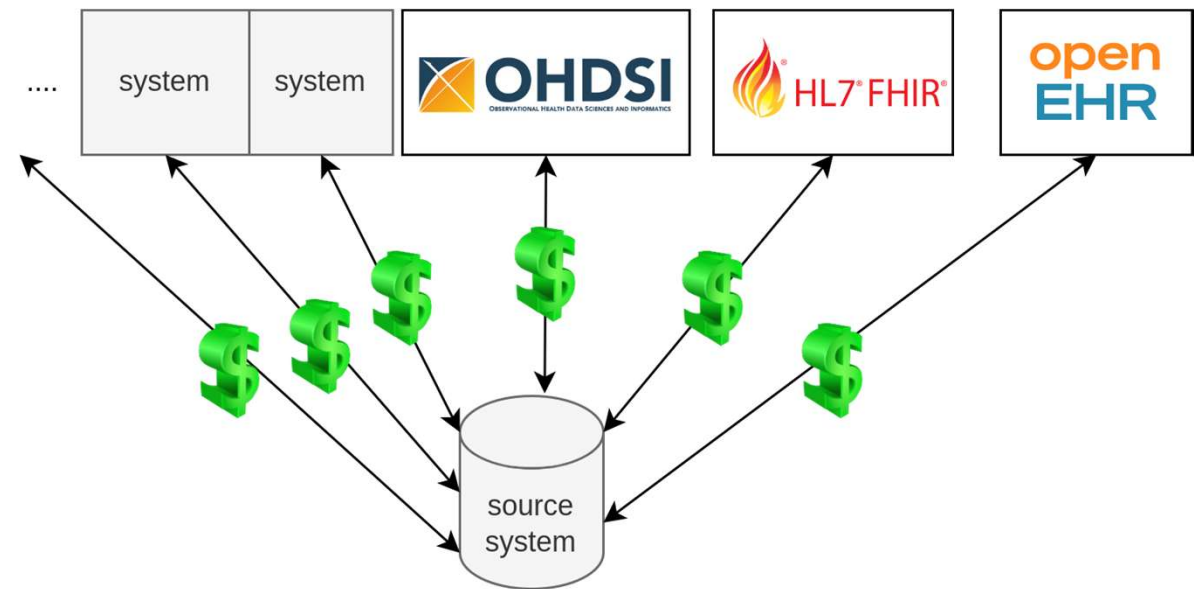
# Problem

# 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

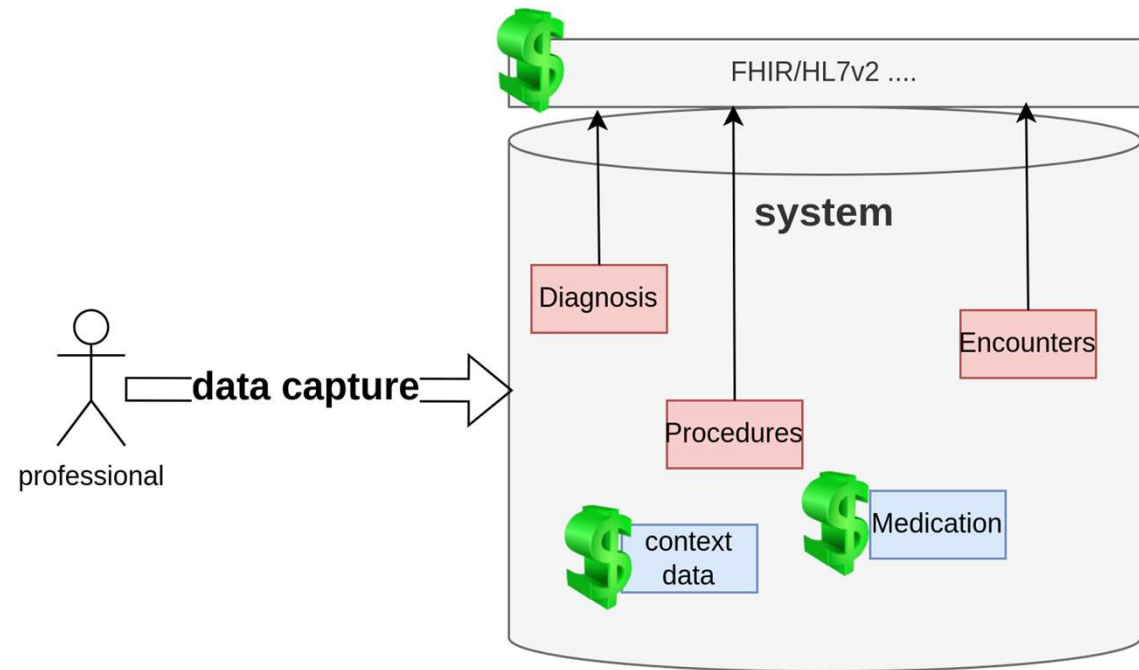
# Extract Transform Load (ETL)

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



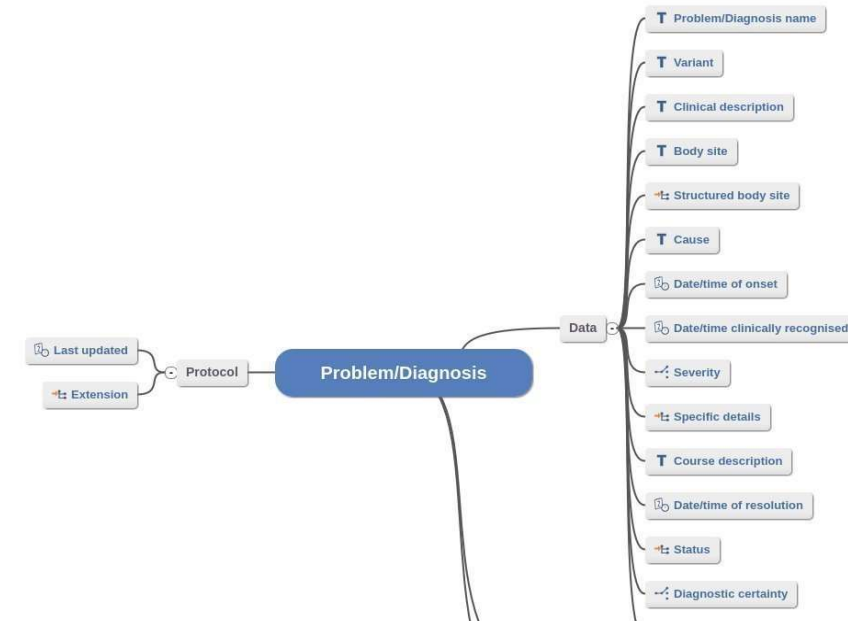
# Interfaces

- 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**

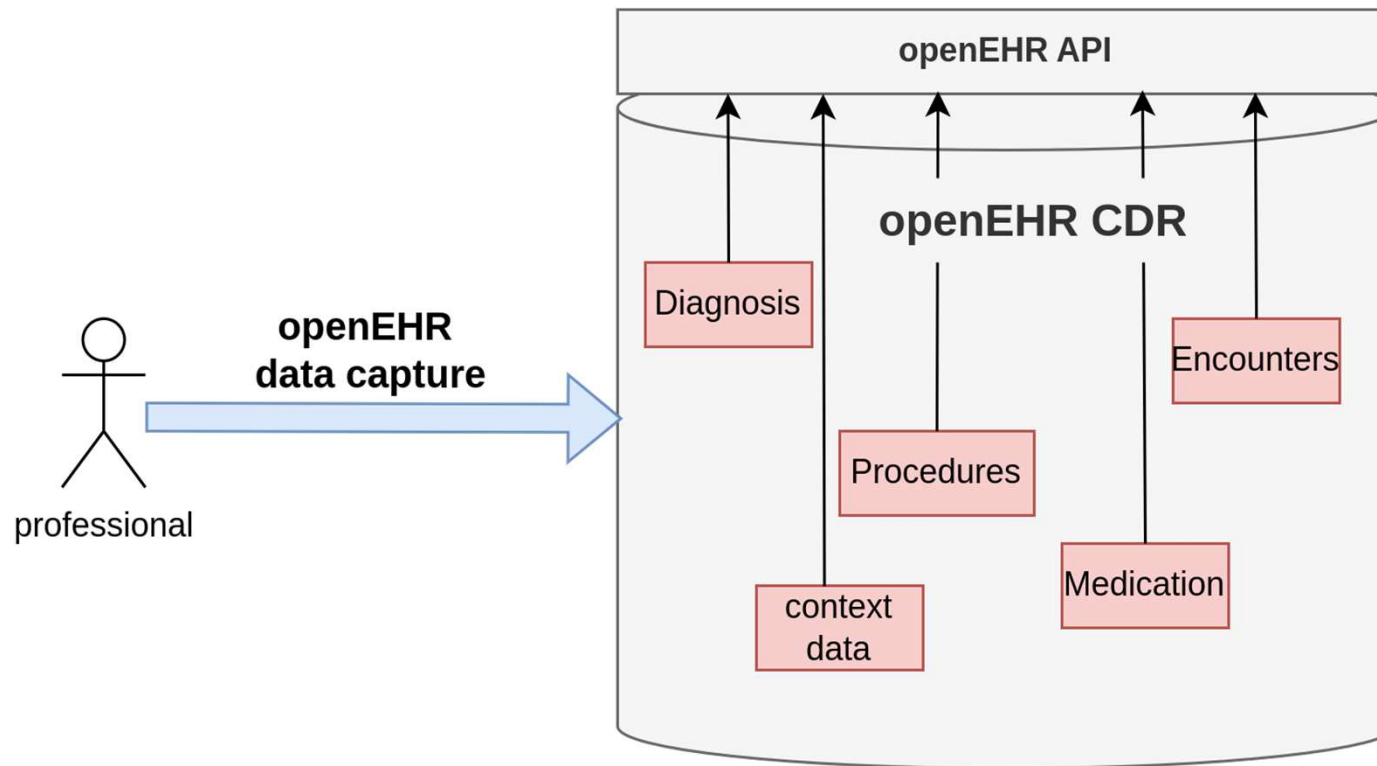




- aims to **standardize** an **EHR**
- excels for standardization **at point of capture**
- **international models** (archetypes) cover more than **rudimentary data**
- aim to **represent** as much **data** as **possible** (inclusive)
- **federation** (HiGHmed)



# Standardizing on the point-of-capture

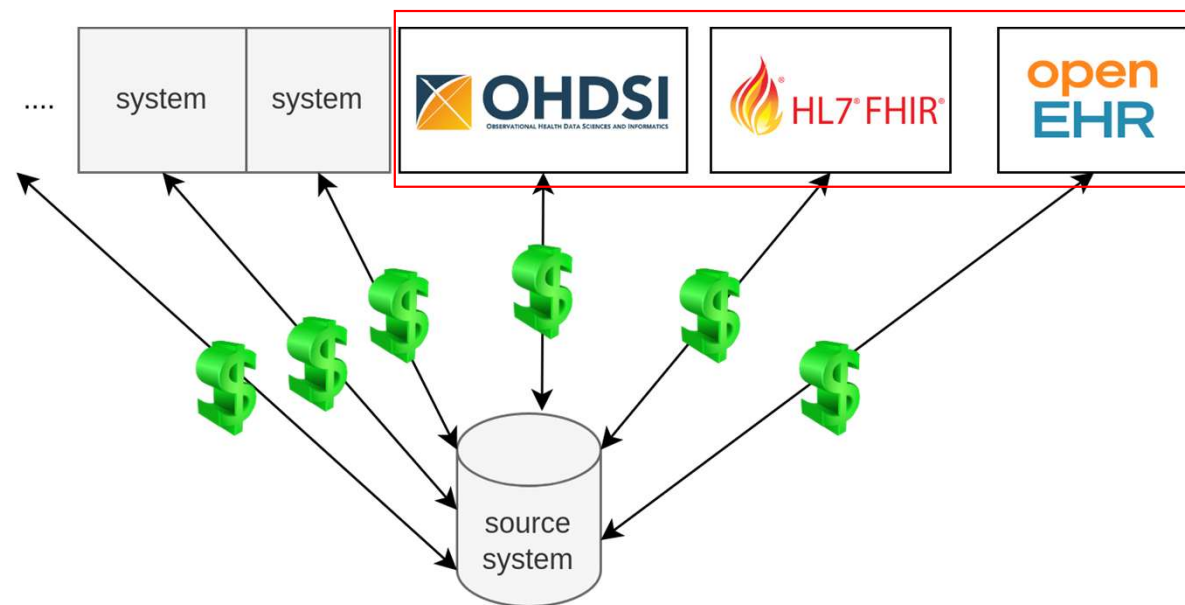




# Problem

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

# Standardized to Standardized





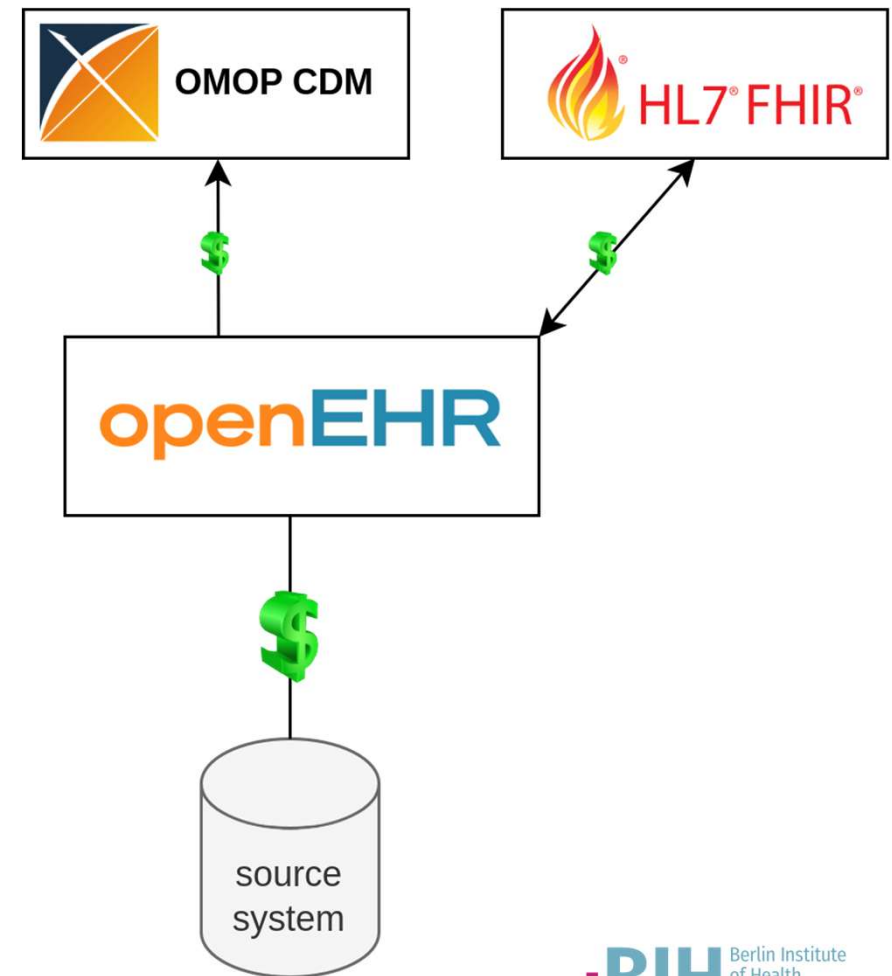
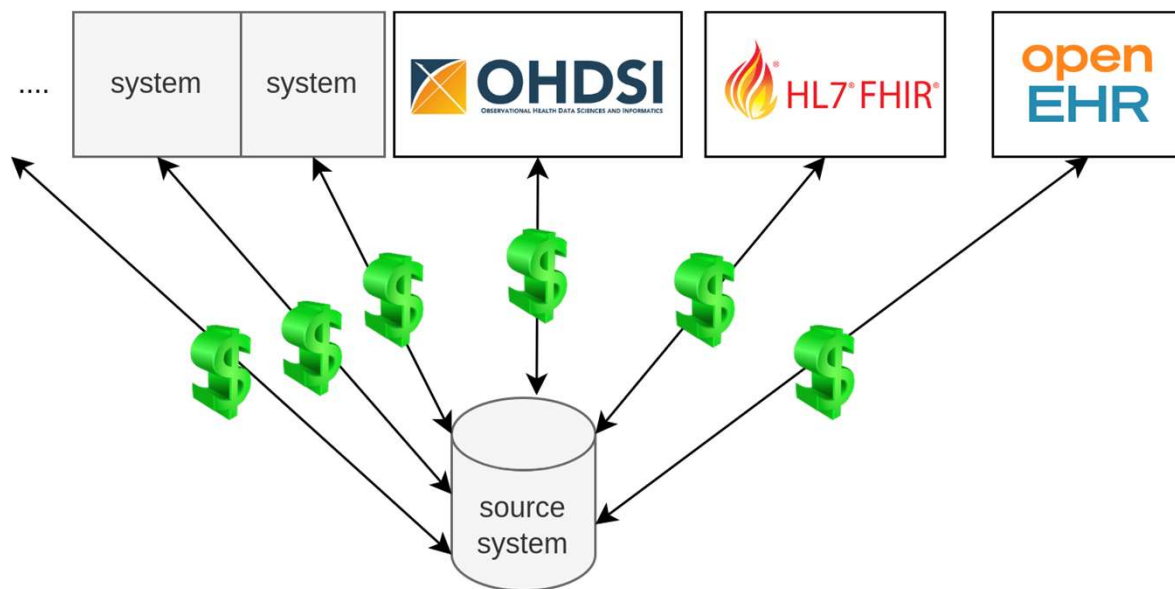
Vision

# 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**

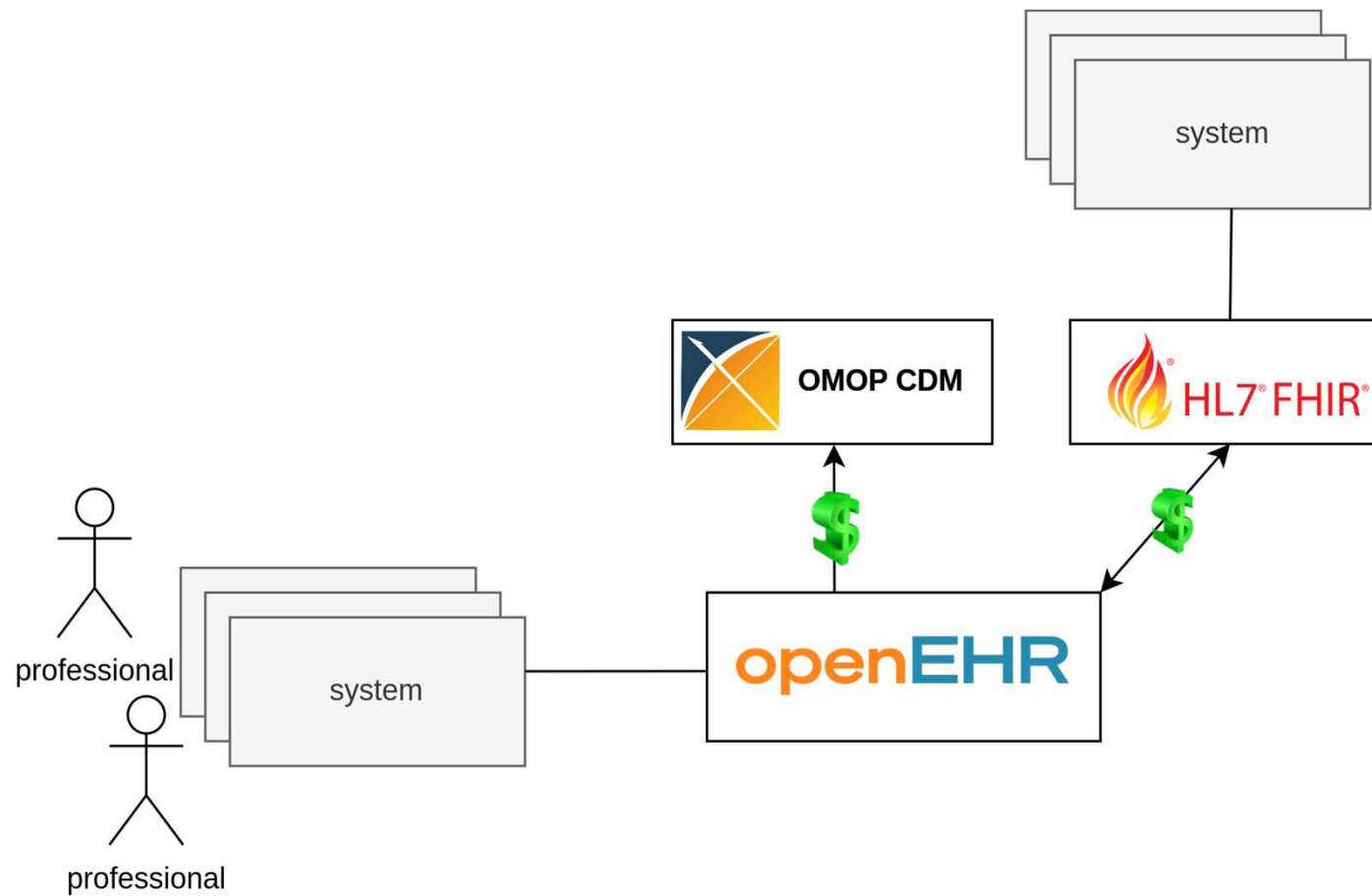


# The idea

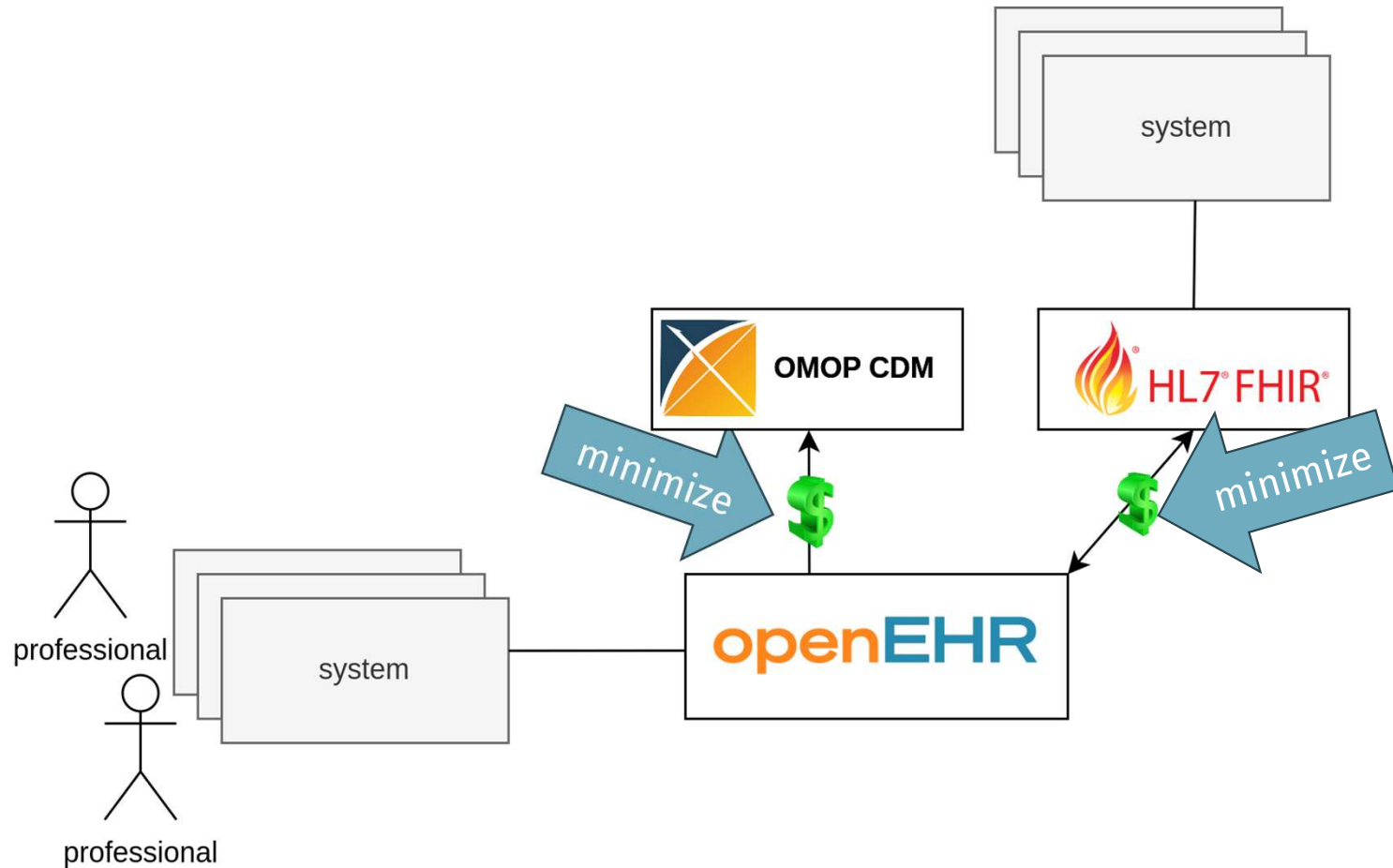




## Combined ....



# How do we minimize cost?



A painting of ancient ruins on a hill at sunset. The scene features a long, partially collapsed colonnade of classical columns on a raised platform. In the foreground, there are stone steps and a low wall. The background shows rolling hills under a warm, orange-hued sky with a setting or rising sun. The text "Eos & OMOCLE" is overlaid in the center.

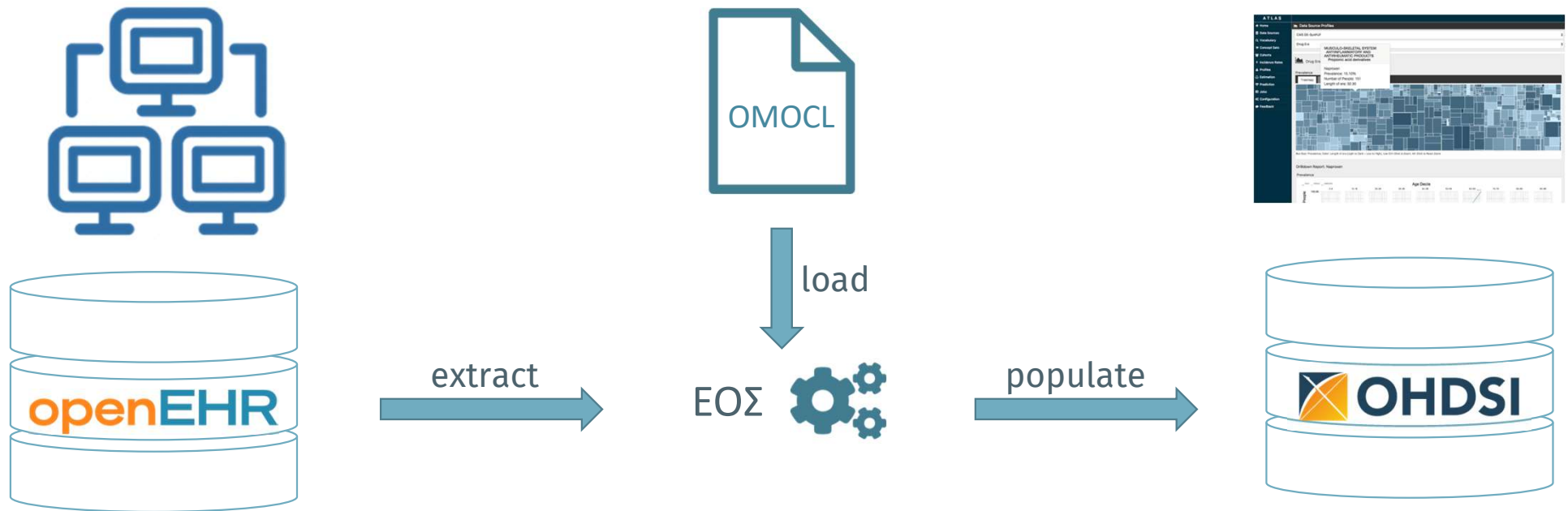
Eos & OMOCLE

# 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



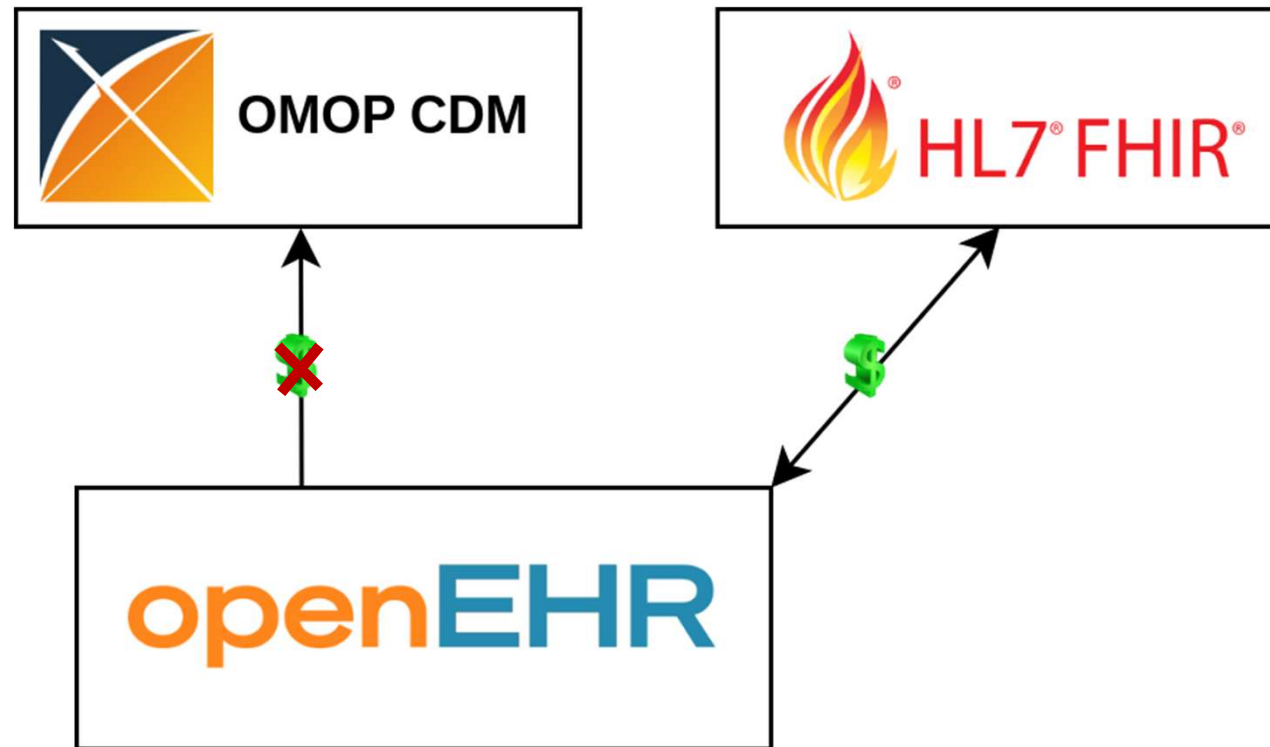
- **release** in the **upcoming weeks**
  - with **veratech for health**
- transforms **all data stored** in **184 international archetypes** to **OMOP CDM**
  - works **out of the box**
  - all **openEHR platforms** now **support OMOP**
- **tooling** and **engine** is **open source**

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

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



# Result

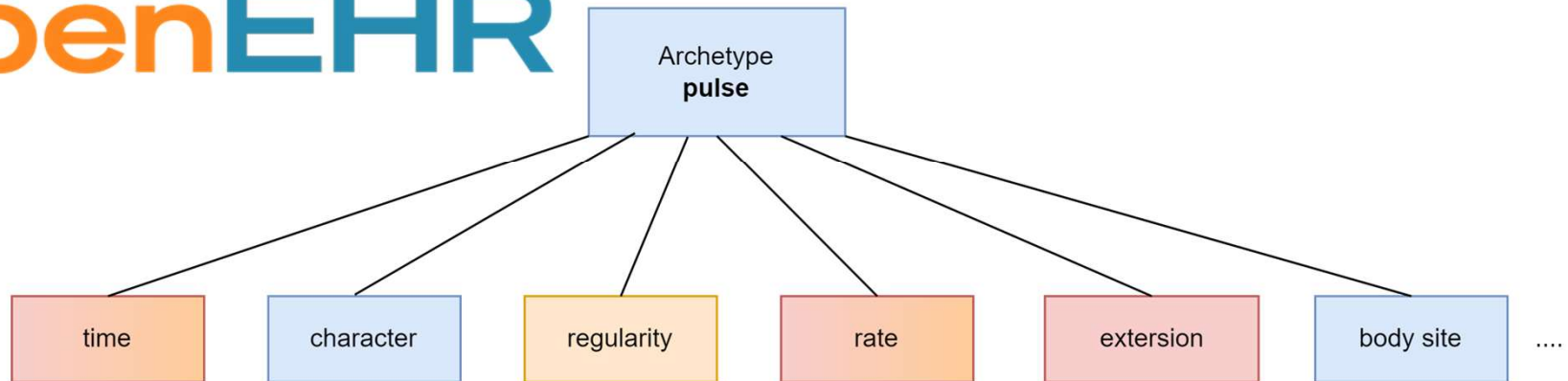
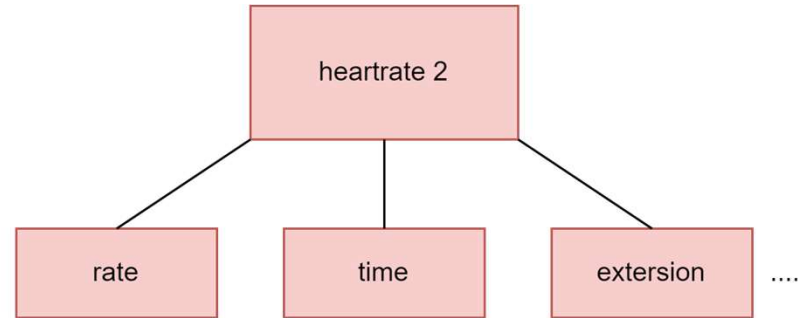
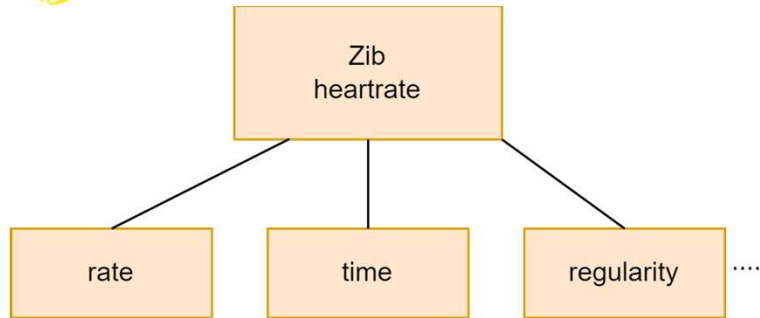


A painting of two figures in silhouette, wearing long robes and hats, standing on a grassy hill and looking out over a vast, hazy landscape at sunset. The sky is a mix of orange, yellow, and grey, with the sun low on the horizon. The text 'FHIRconnect' is overlaid in white, sans-serif font across the middle of the image.

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**

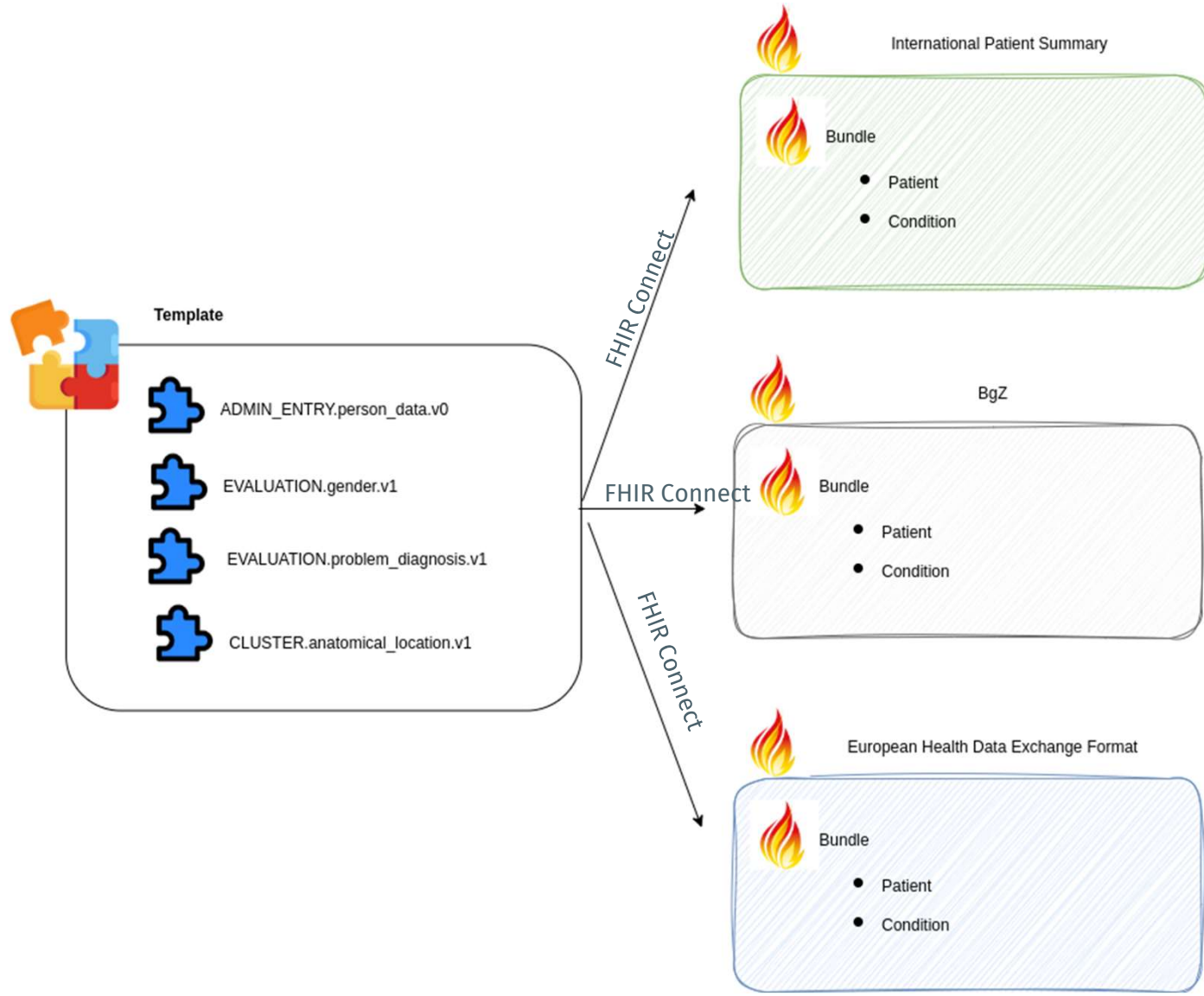




# FHIRconnect & FHIRBridge

- **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 left sidebar contains navigation options like 'All Resources', 'Subdomain', 'Project / incubator', and 'Archetypes'. The main content area is titled 'Blood pressure' and includes a 'Mappings & Queries' section. This section contains four sub-sections: 'FHIR® Mapping', 'OMOP Mapping', 'AQL', and 'Subset Model'. Each sub-section has a description and a note stating 'No documents have been uploaded yet.' Red arrows point to the 'FHIR® Mapping' and 'OMOP Mapping' sections, highlighting the text 'FHIR' and 'OMOP' respectively.

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 ×

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.

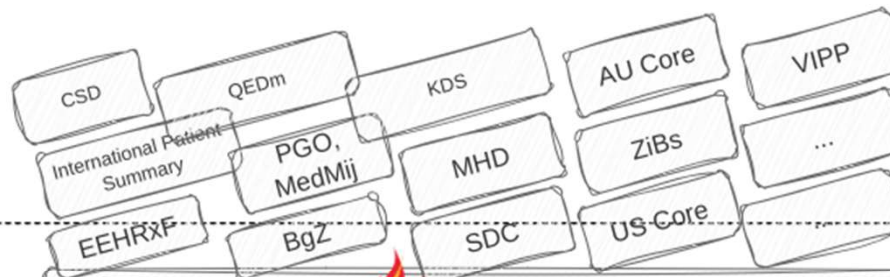
Exchange  
• for openEHR systems  
**openEHR**

### Applications, Region, Outside world



### Profiles, Implementation Guides

- separated from Clinical Data Repository
- tied to exchange



### FHIR Facade

- attractive to innovation
- use-case driven
- tender & grants compliant
- easy to open-up to (regional) access



### FHIR Connect

- modular mappings
- open sourced mapping language
- bidirectional (query and store)
- reusable mappings, archetype <-> FHIR Data Type, Resources

FHIR Connect

### Clinical Data Repository

- modeled by clinicians
- "future proof" models
- granular, scalable, ..
- profile & use case agnostic
- vendor agnostic
- for life

**openEHR**

### Operational Database



INNOVATION

EXCHANGE

PERSISTENCE

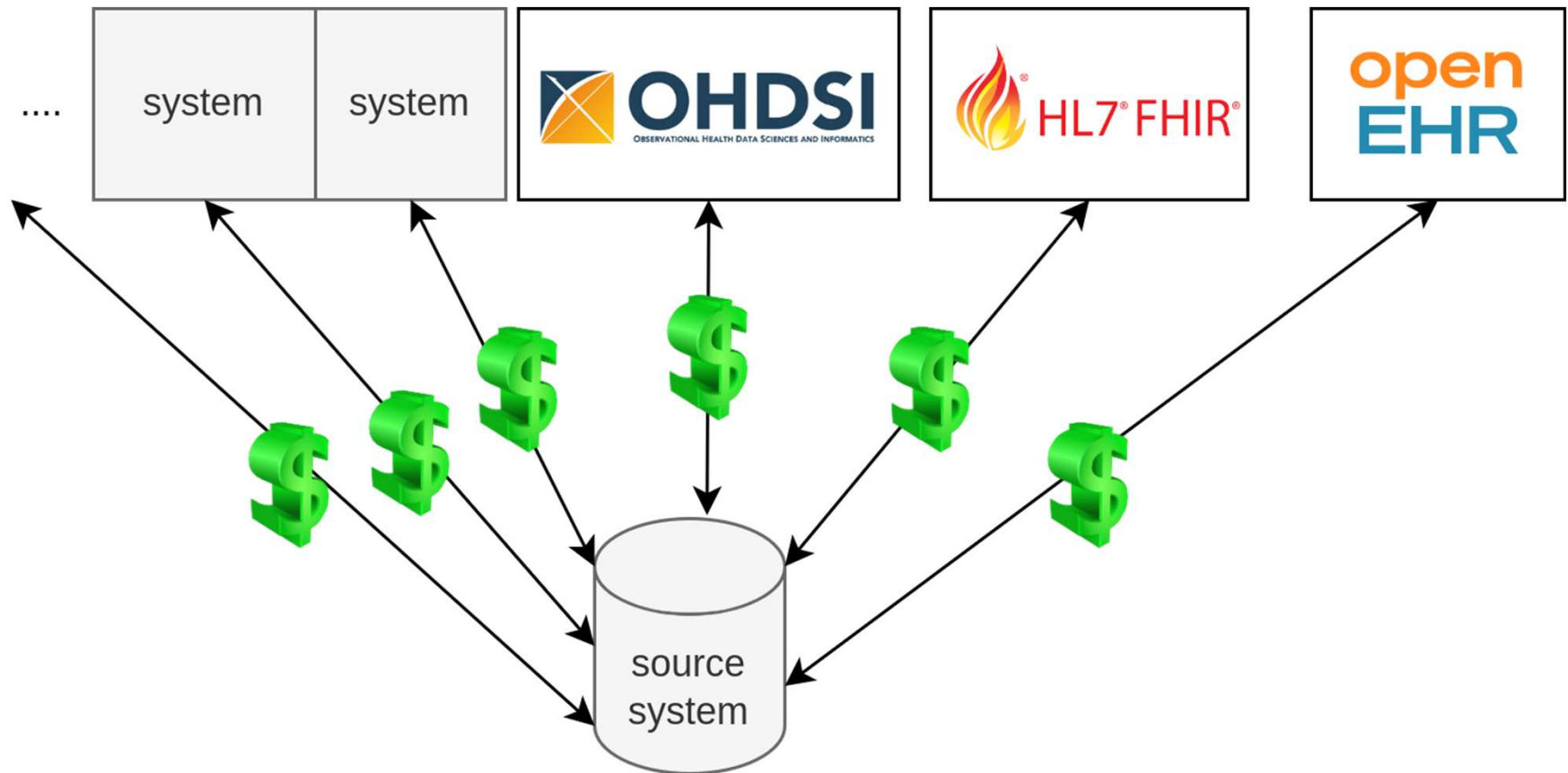
# Conclusion

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

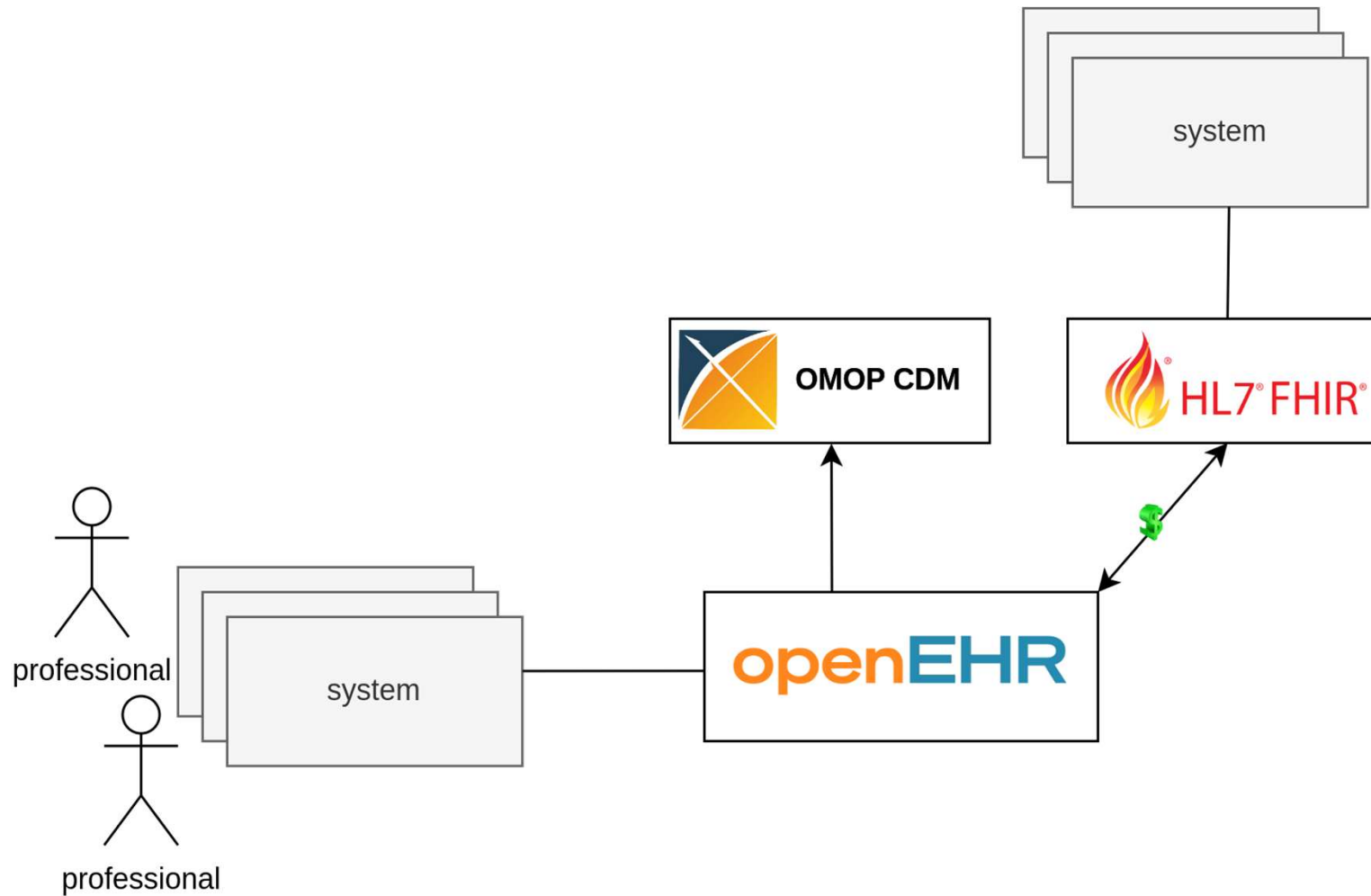




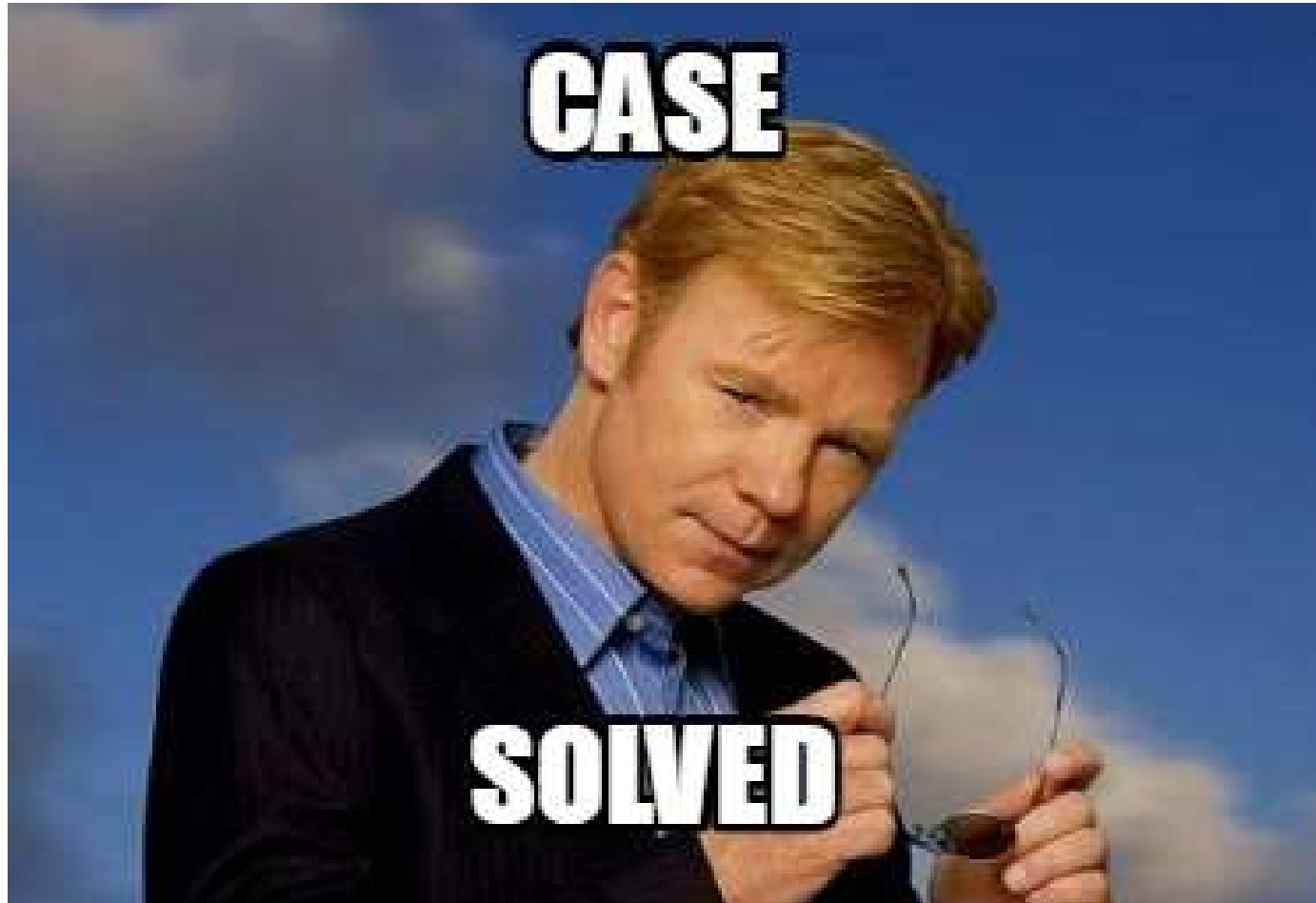
## Before



# Result



## Interoperability



A landscape painting depicting a vast, rolling mountain range under a warm, golden sky. The foreground shows dark, textured hills with some sparse vegetation. The middle ground features a series of ridges and valleys, with a few small, dark trees visible. The background consists of distant, hazy mountain peaks. The overall mood is serene and contemplative.

Where to go next

# Federation

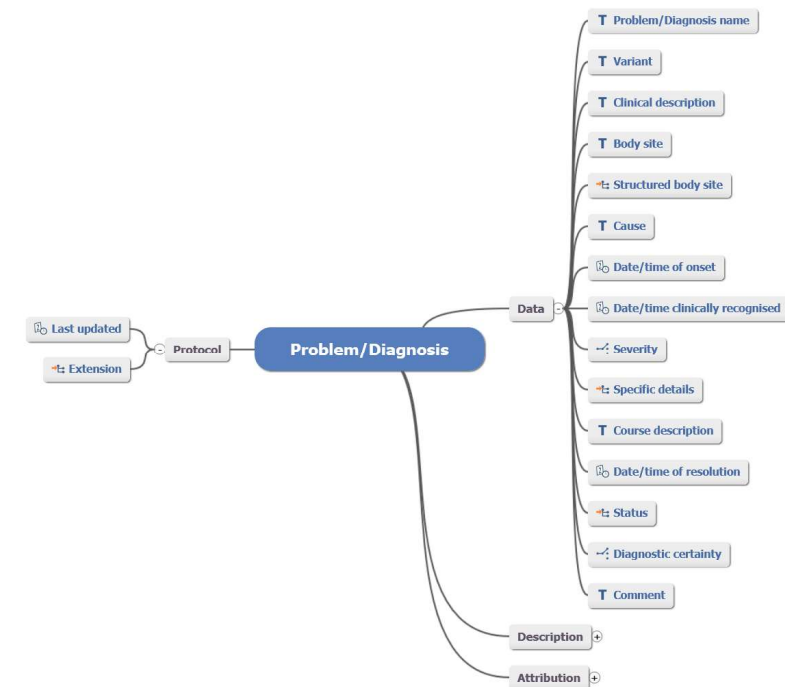
- **same model = same data**
- **AQL**
- **European EHR** is mostly a matter of **connecting openEHR** platforms
  - for those who **support** it
  - **research** has a lot of **use-cases**
- **European EHR network**
  - **kick off next month**





# AI

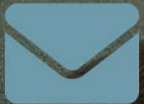
- **downstream interoperability is expensive (ETLs)**
  - **value** for AI ?
- **LLMs** can **interpreted unstandardized data**
  - **cheaper, more information** (cause of no **nit-picking**)
- one more argument for **standardized data-capture**
- inclusive **data** models as **openEHR**
  - contains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