The future proof Clinical Data Repository

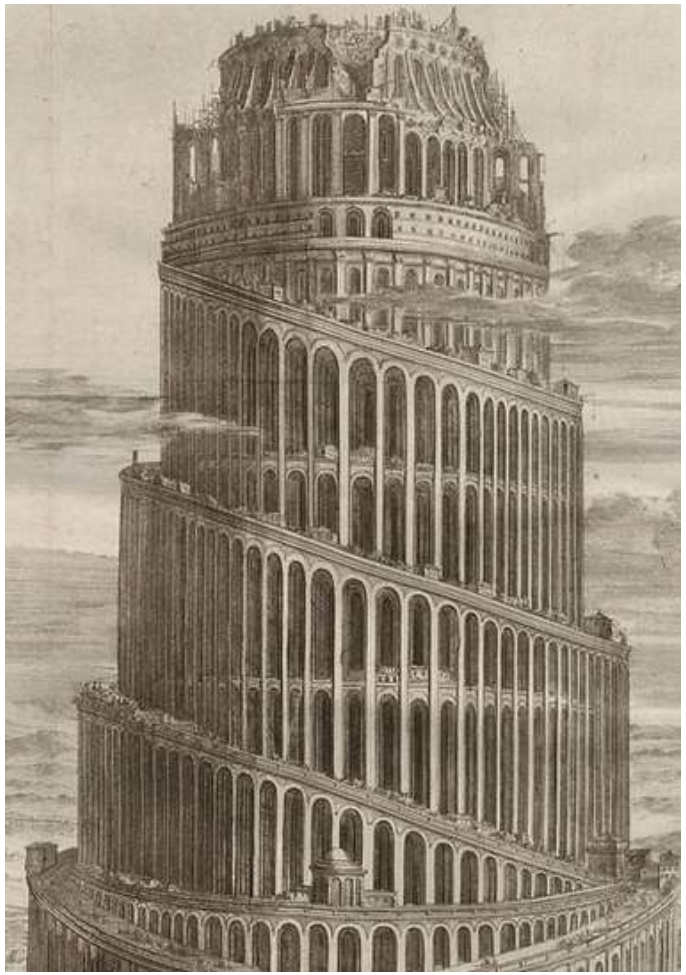
Bridging the gap between openEHR, FHIR and OMOP

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

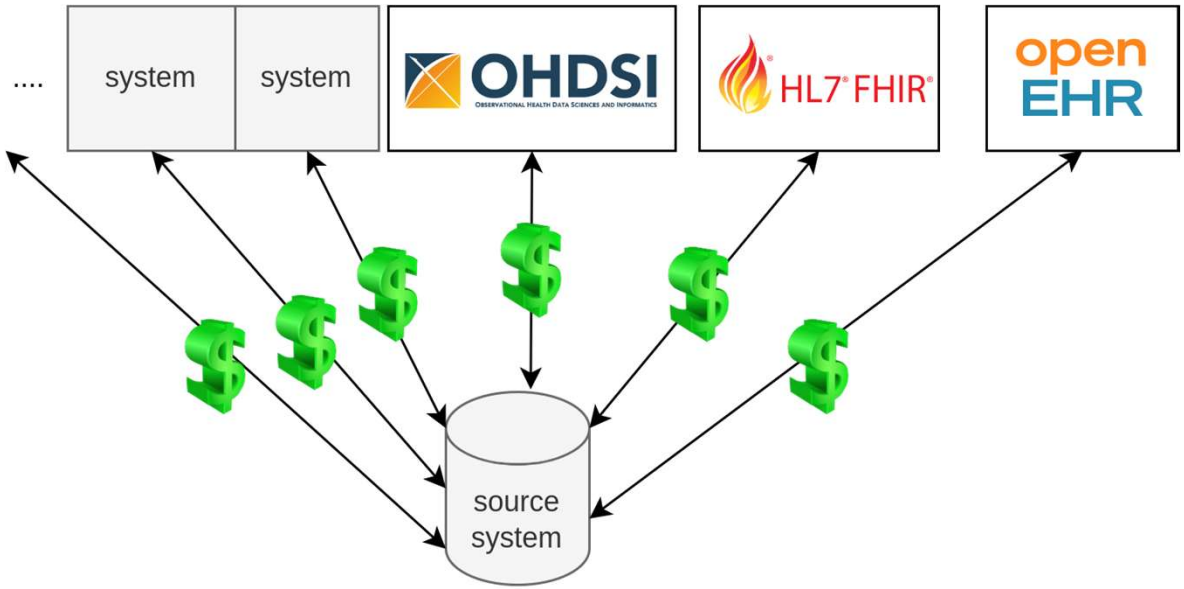

Problem

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)

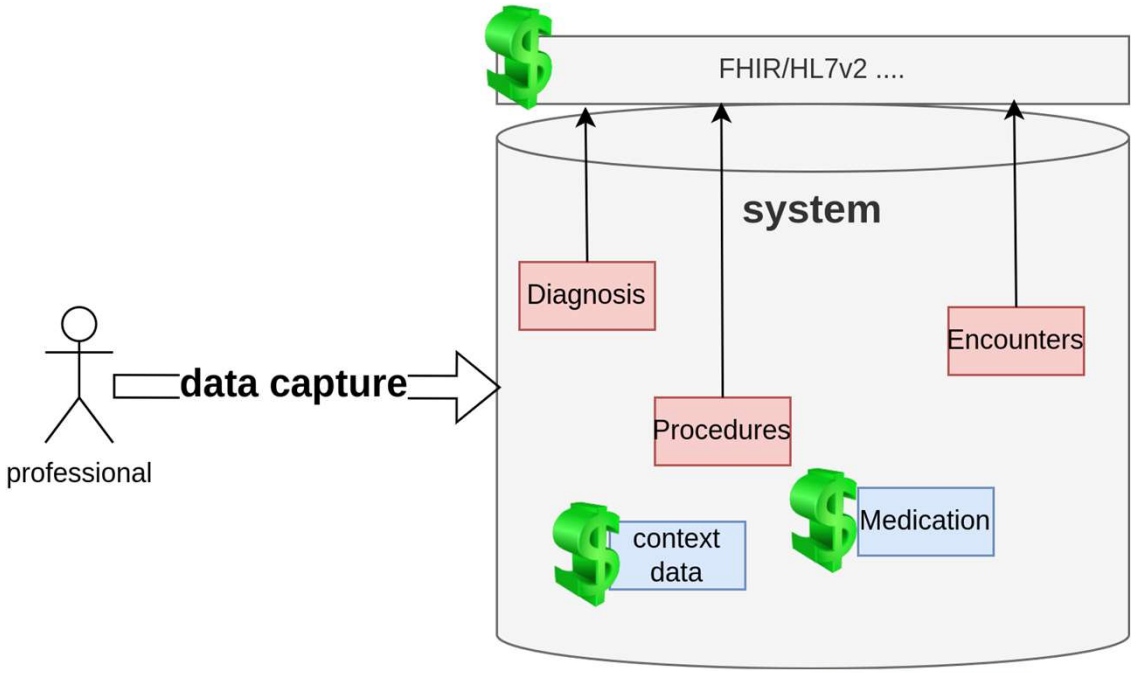
- **integration** process to a proprietary or **standardized** format
- **expensive, resource-intensive**
- varies **depending** on the **scope**
- **limits** also the **data shared**



BIH Berlin Institute of Health @Charité

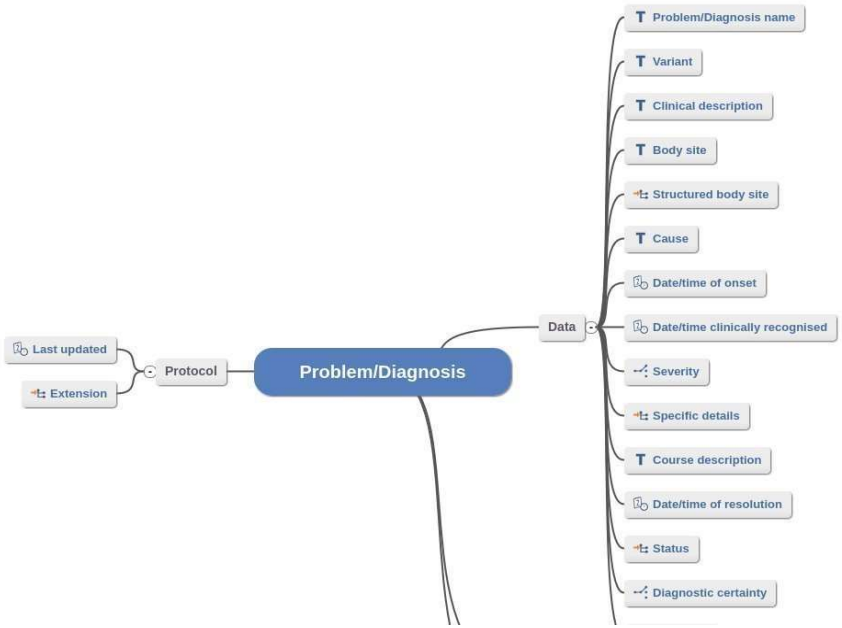
Interfaces

- 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**

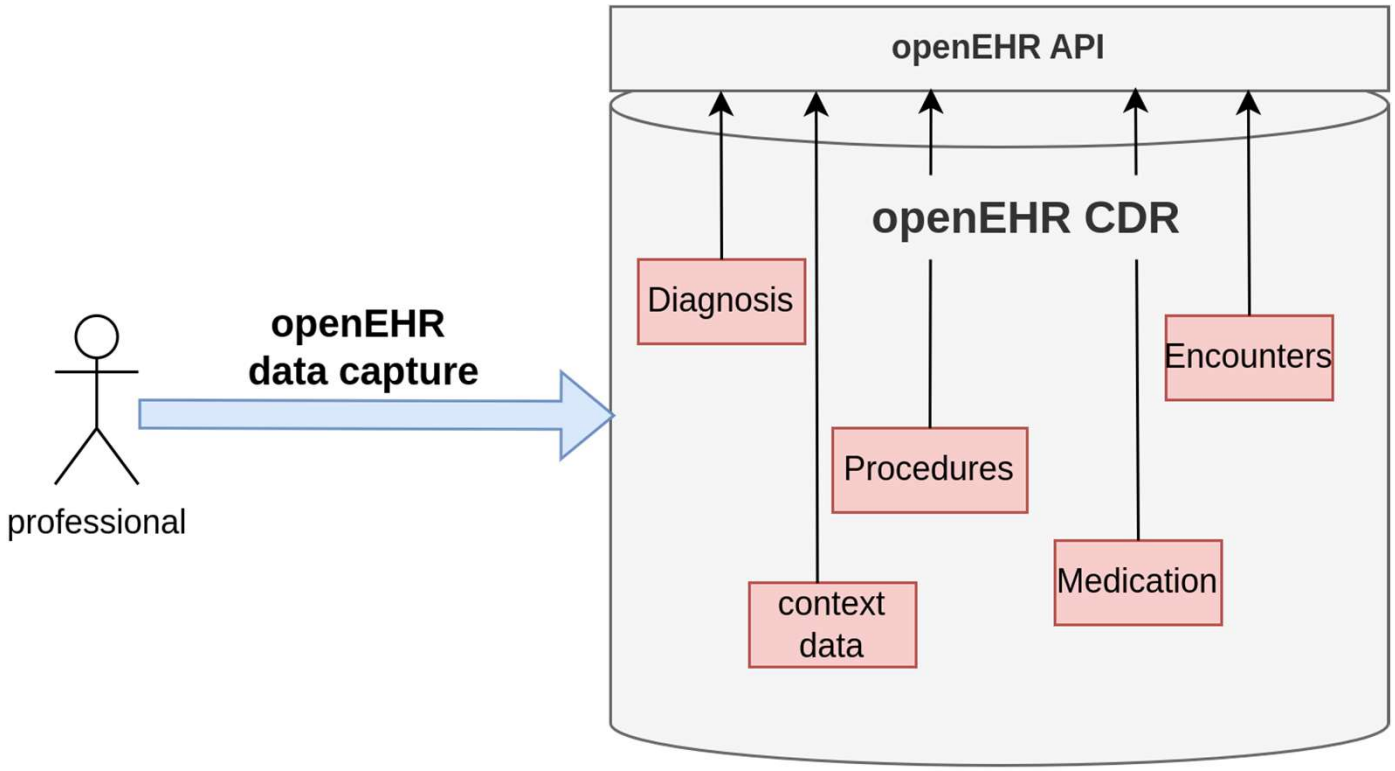


openEHR

- 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

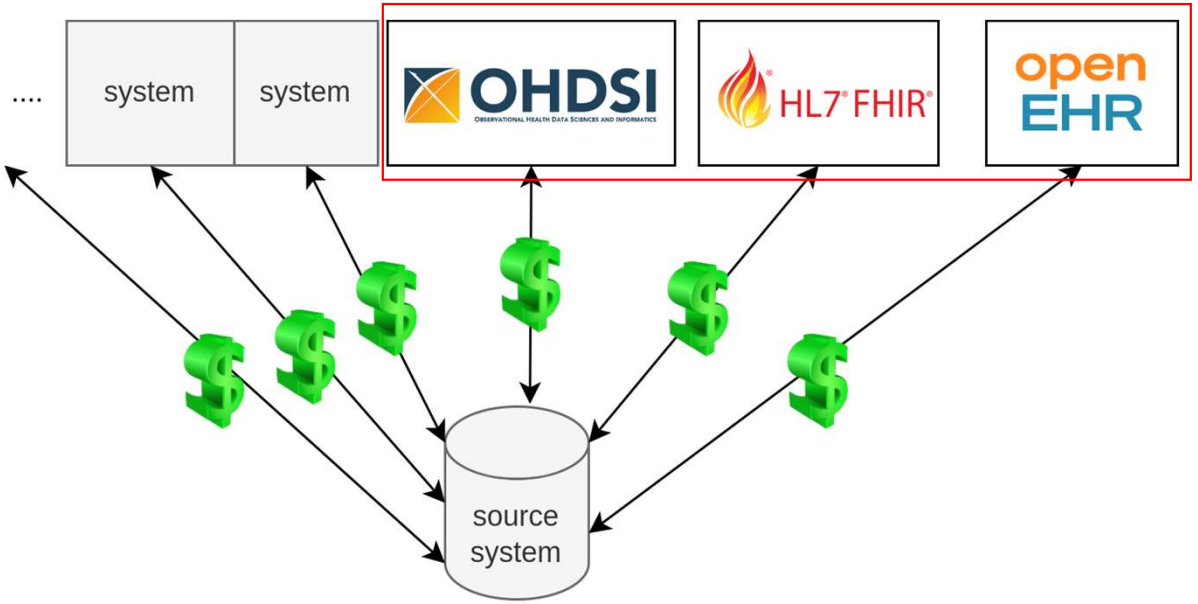


BIH Berlin Institute of Health @Charité

Problem

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

Standardized to Standardized

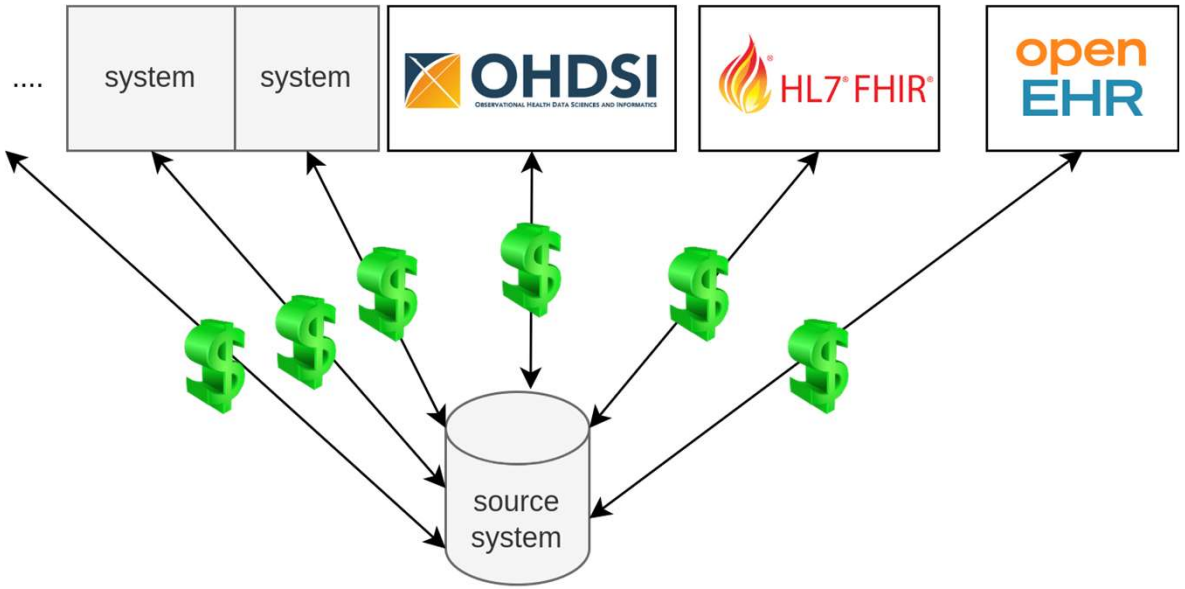


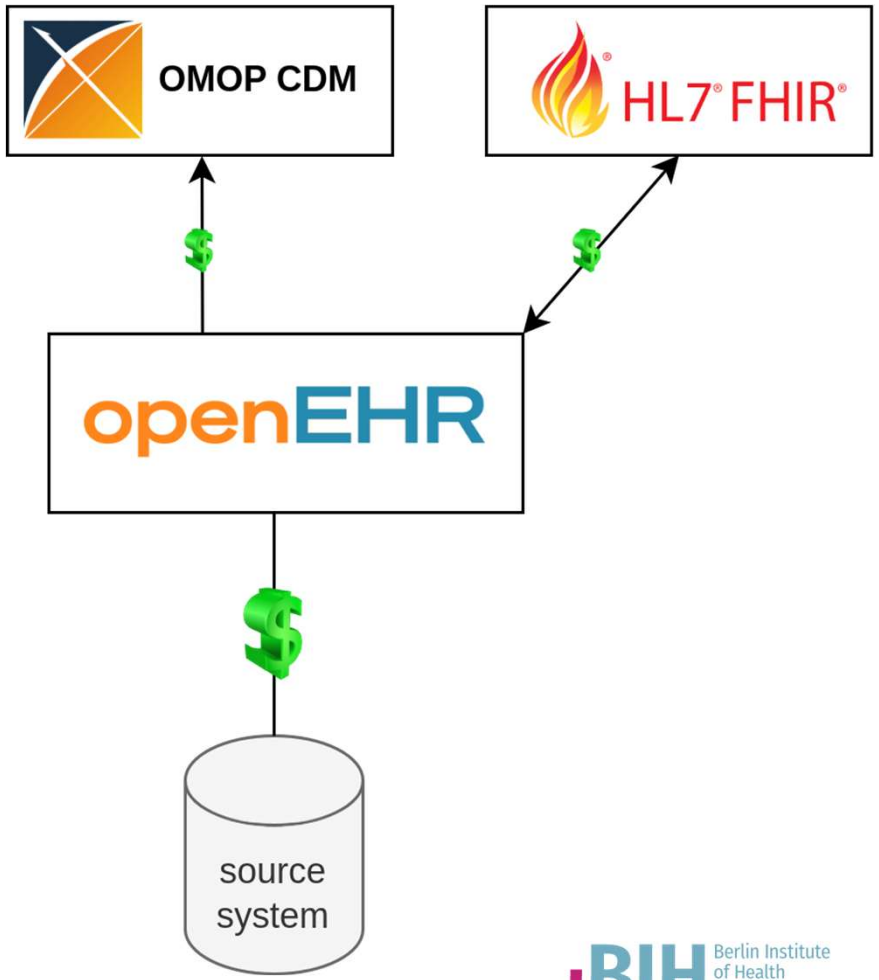

Vision

Automatic integration between standards

- **definition** of **ETLs between standards promises** to **save resources**
- **high sematic 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**

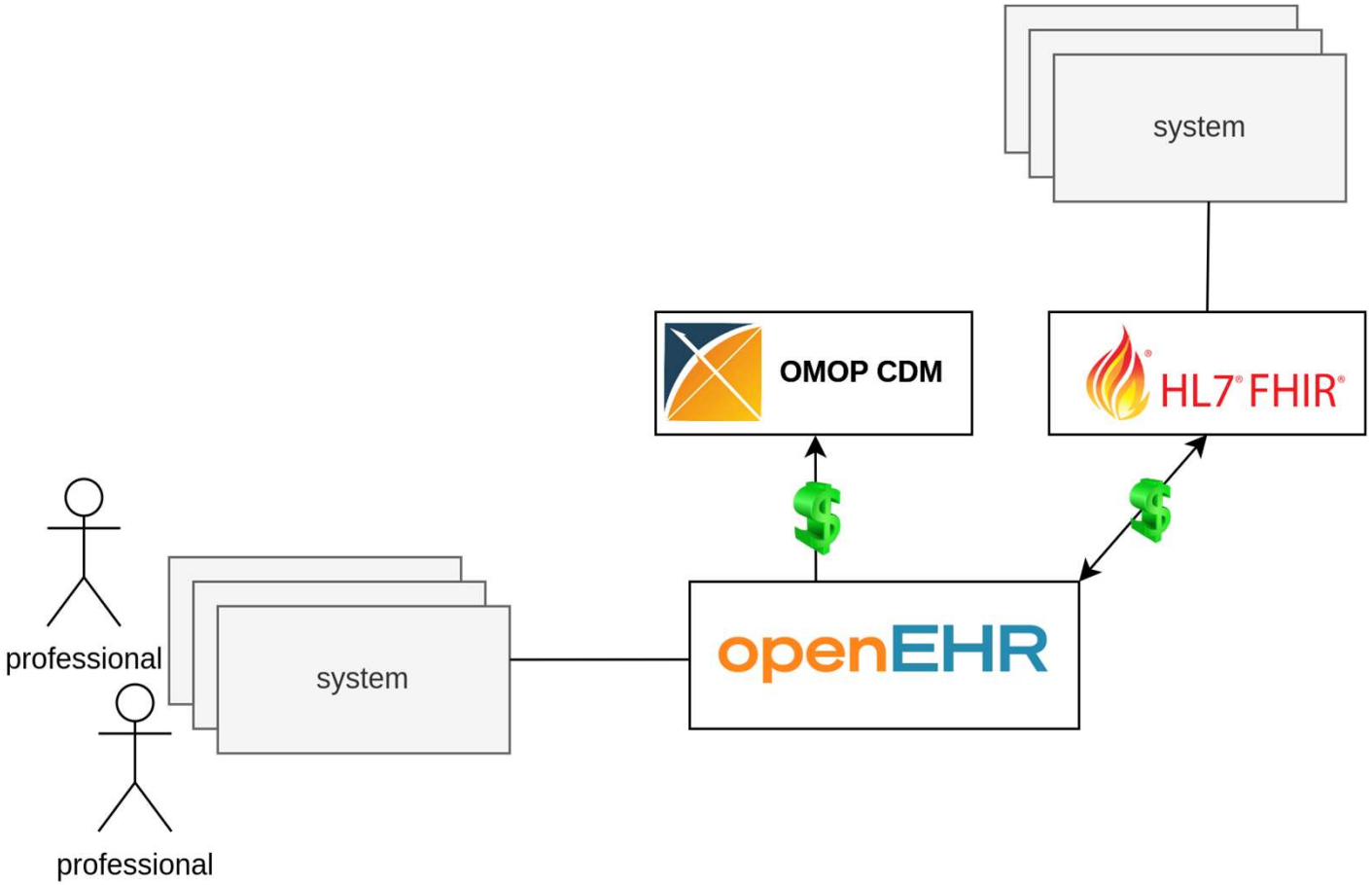
The idea





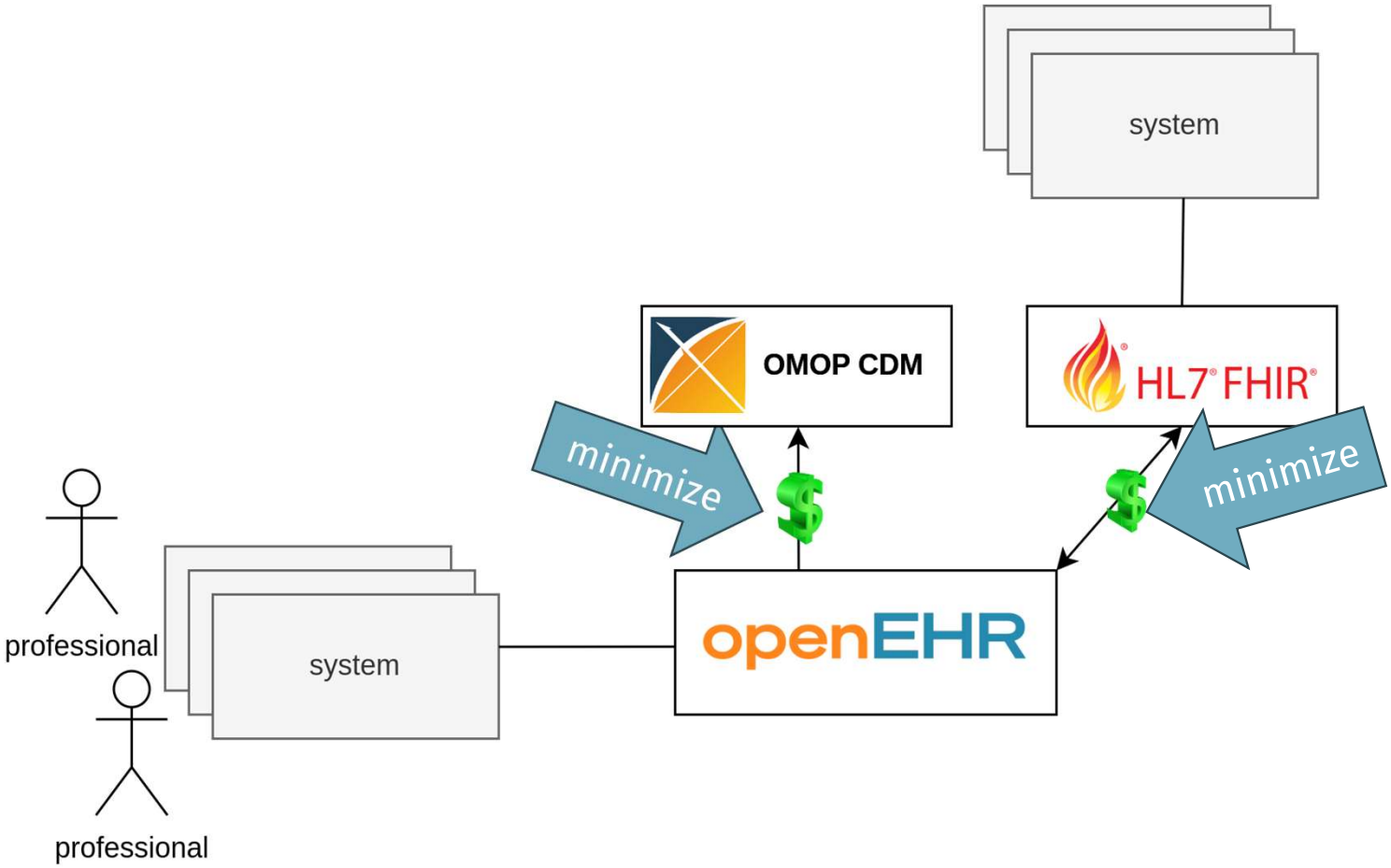
BIH Berlin Institute of Health @Charité

Combined ....



BIH Berlin Institute of Health @Charité

How do we minimize cost?



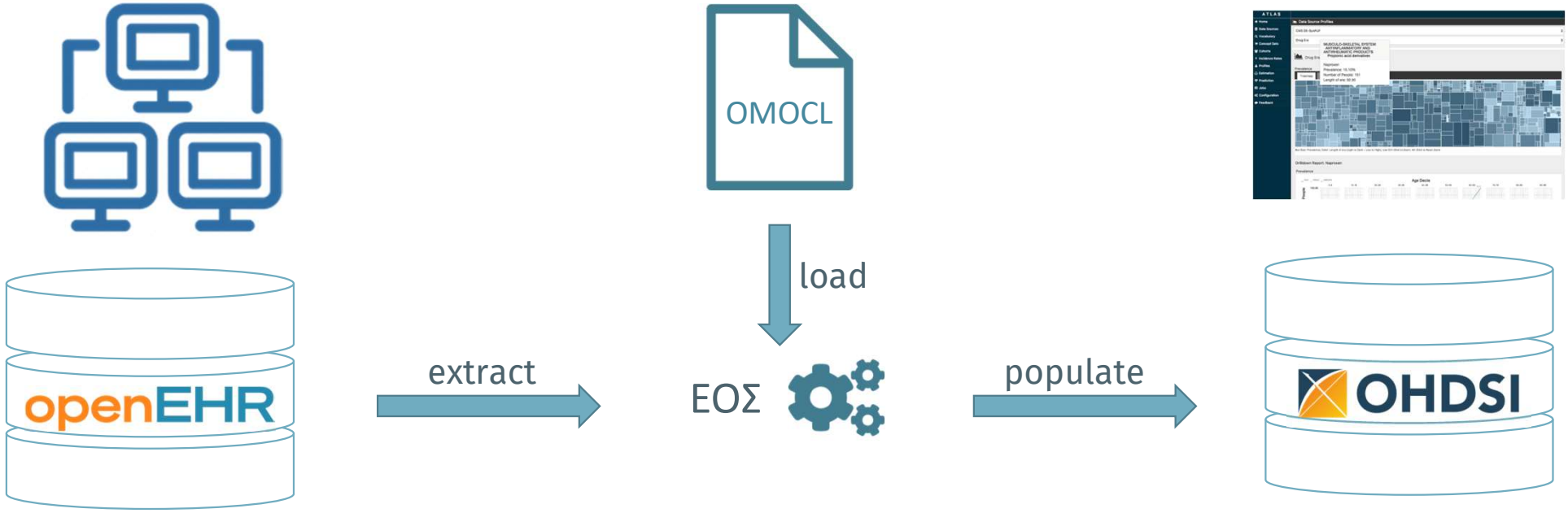
BIH Berlin Institute of Health @Charité


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

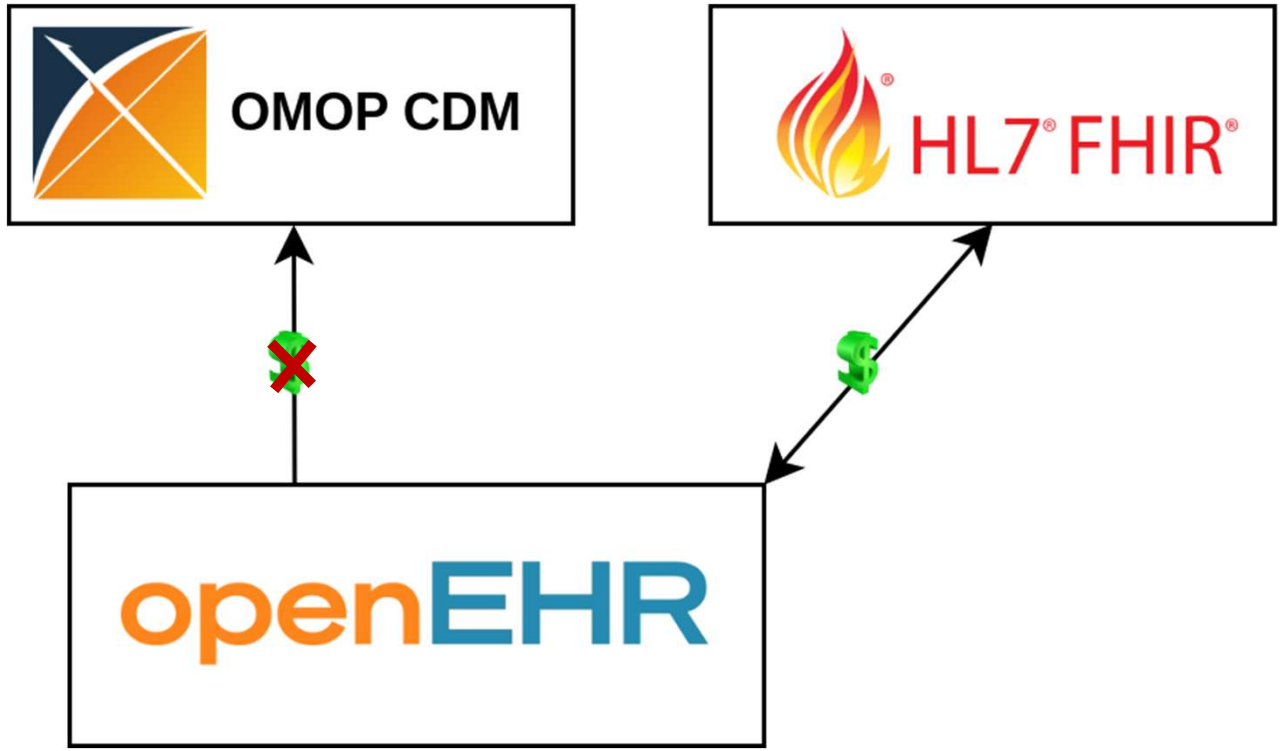
- **release** in the **upcoming weeks**
  - with **veratech for health**
- transforms **all data stored** in **184 international archetypes** to **OMOP CDM**
  - works **out of the box**
  - all **openEHR platforms** now **support OMOP**
- **tooling** and **engine** is **open source**

https://github.com/SevKohler/OMOCL
https://github.com/SevKohler/Eos

HiGHmed
Medical Informatics

BIH Berlin Institute of Health @Charité

Result

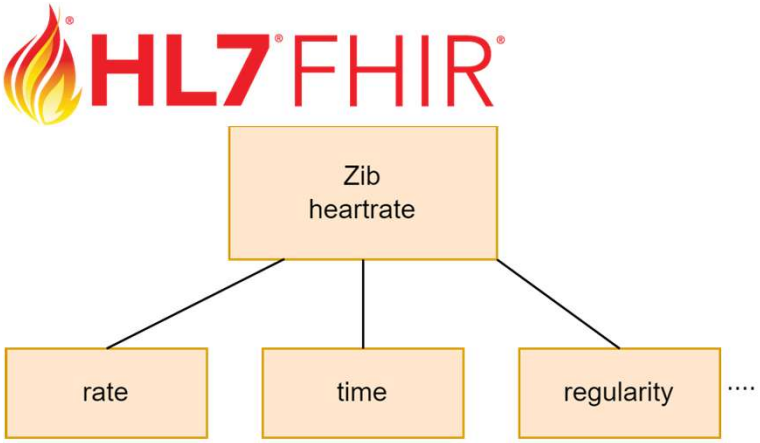


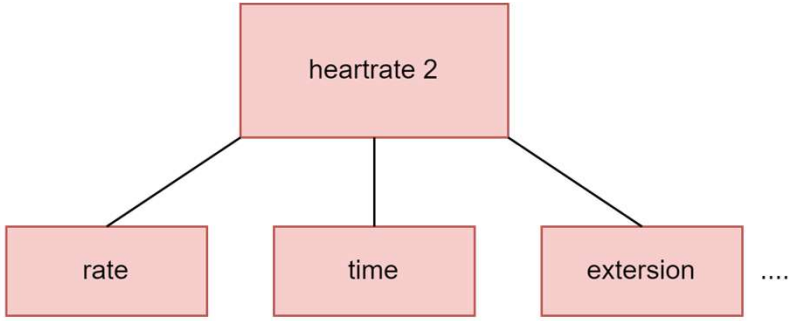

FHIRconnect

Fast Healthcare Interoperability Resources (FHIR)

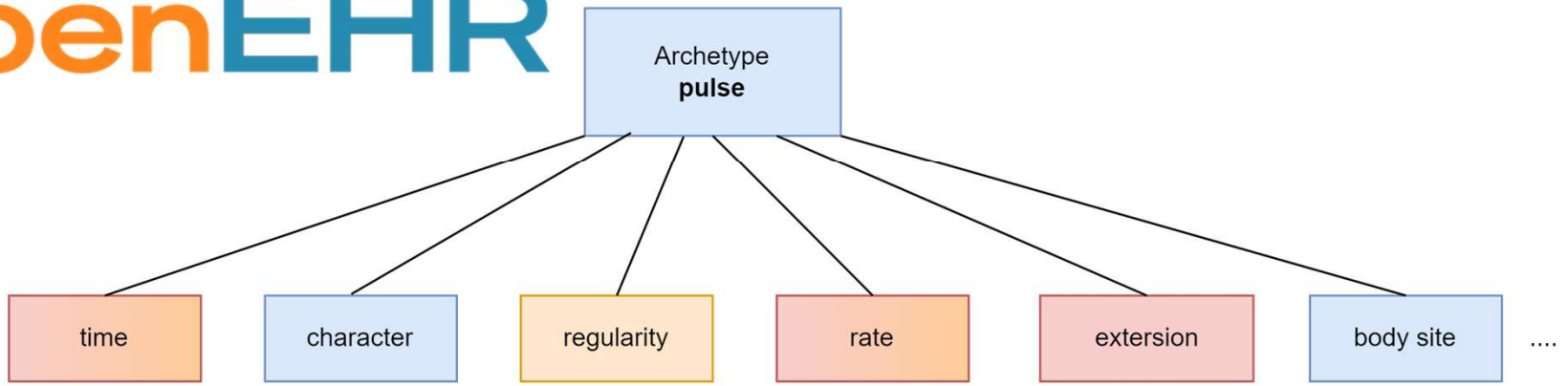
- defined by **HL7**
- **used** to **standardize data exchange** of **systems**
- **defines** a **generic data model**, so called "**resources**"
- these are **extended** using **profiles** for the **specific** use-cases
- **leads** to **interoperability problems**
  - each **implementation** and **initiative**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

[1] *Kramer MA. Reducing FHIR "Profiliferation": A Data-Driven Approach. AMIA Annu Symp Proc. 2023 Apr 29;2022:634-643. PMID: 37128432; PMCID: PMC10148270.*





openEHR



BIH Berlin Institute of Health @Charité

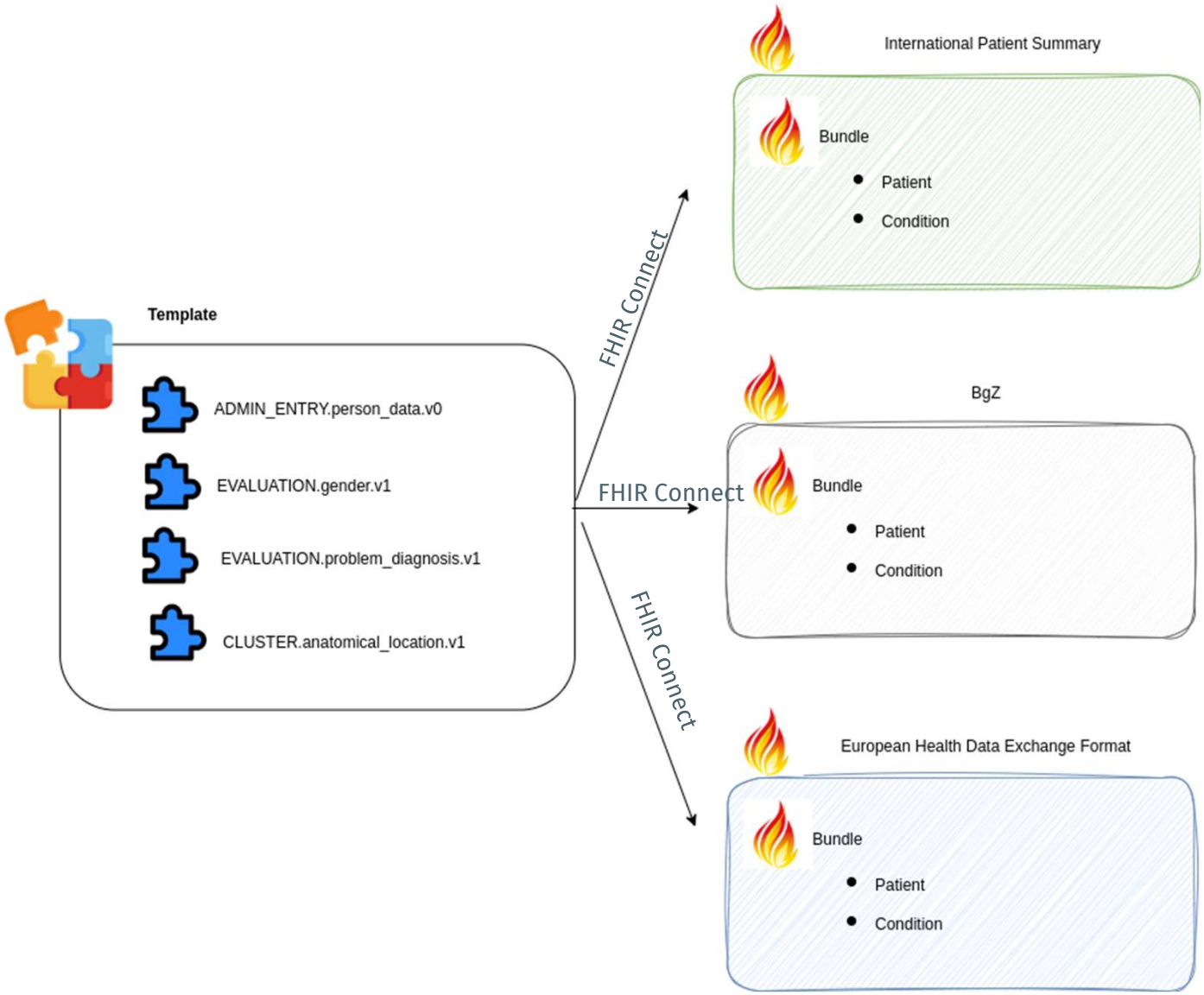
FHIRconnect & FHIRBridge

- **HiGHmed e.V., Medblocks, Gasper Andrejc** (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**

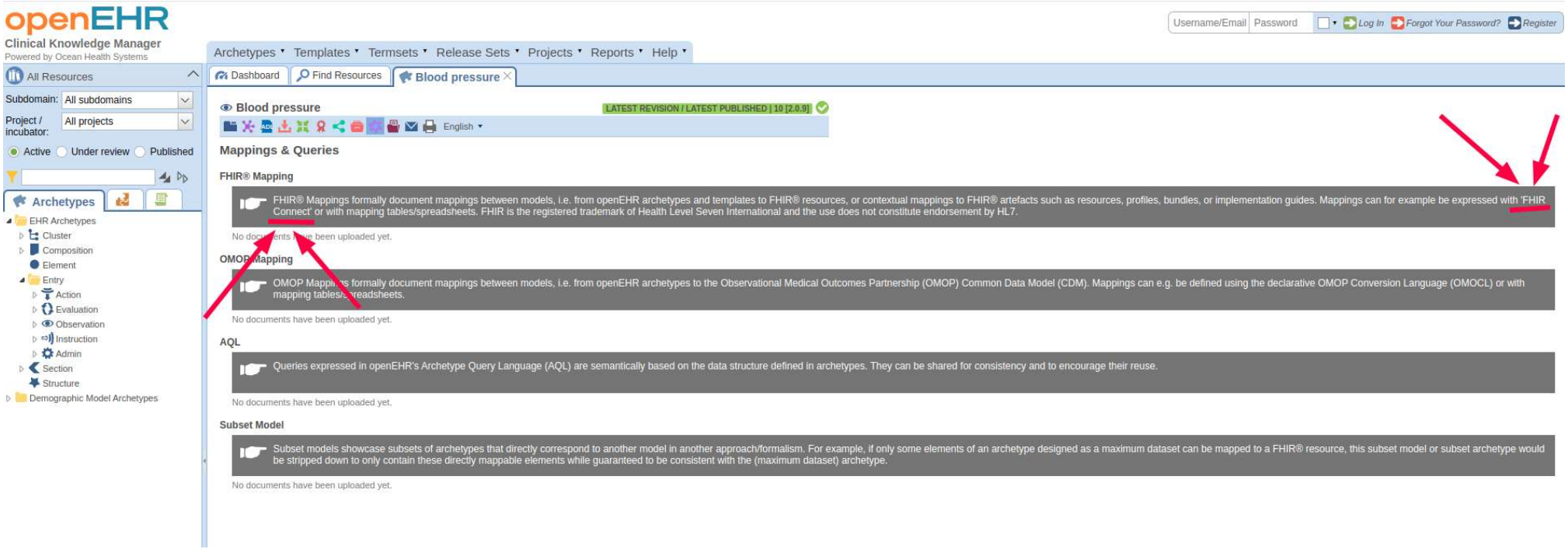
Medblocks

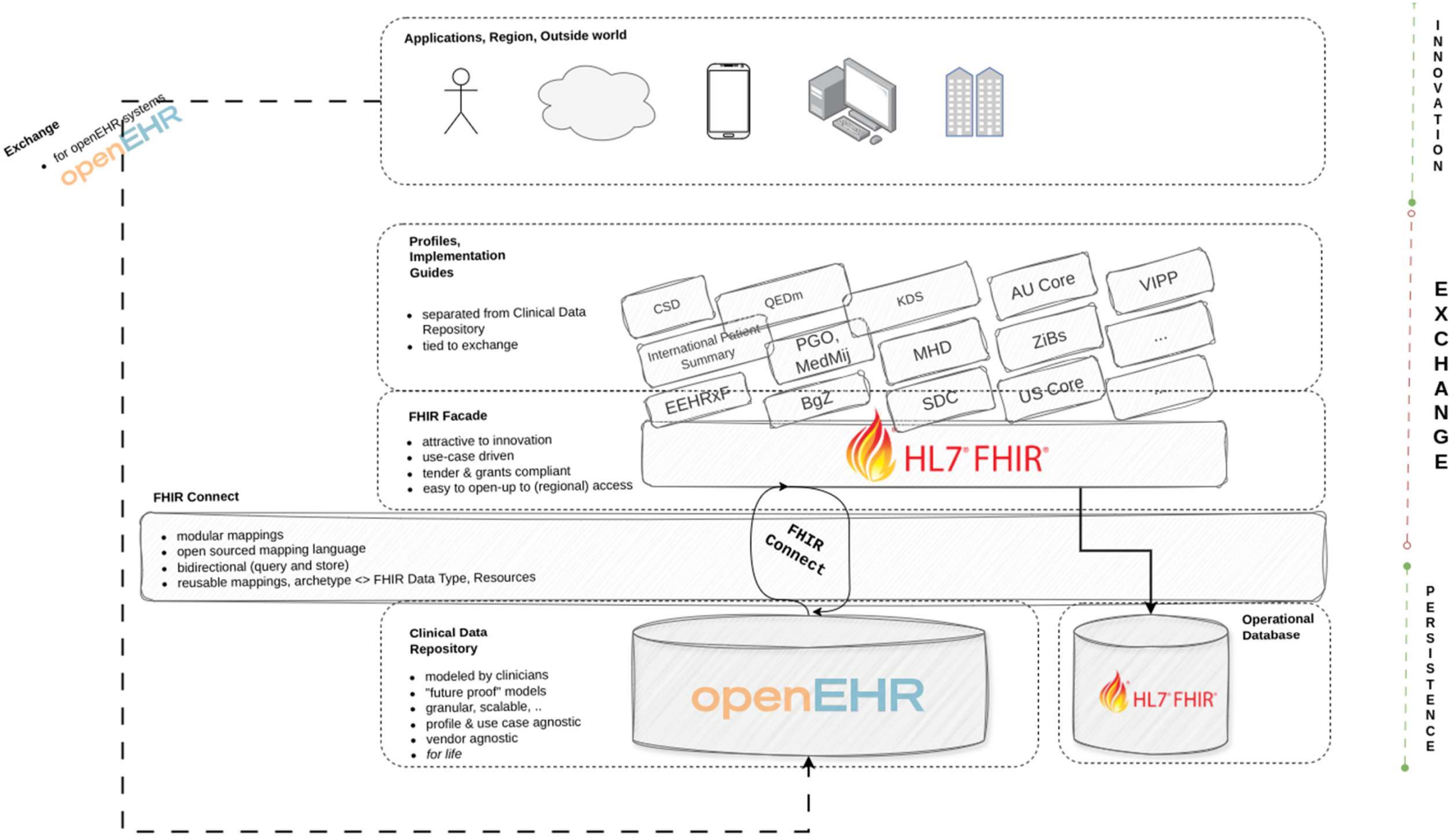
HiGHmed Medical Informatics

BIH Berlin Institute of Health @Charité


Template
ADMIN_ENTRY.person_data.v0
EVALUATION.gender.v1
EVALUATION.problem_diagnosis.v1
CLUSTER.anatomical_location.v1
FHIR Connect
FHIR Connect
FHIR Connect
International Patient Summary
Bundle
Patient
Condition
BgZ
Bundle
Patient
Condition
European Health Data Exchange Format
Bundle
Patient
Condition

Mappings as part of the model



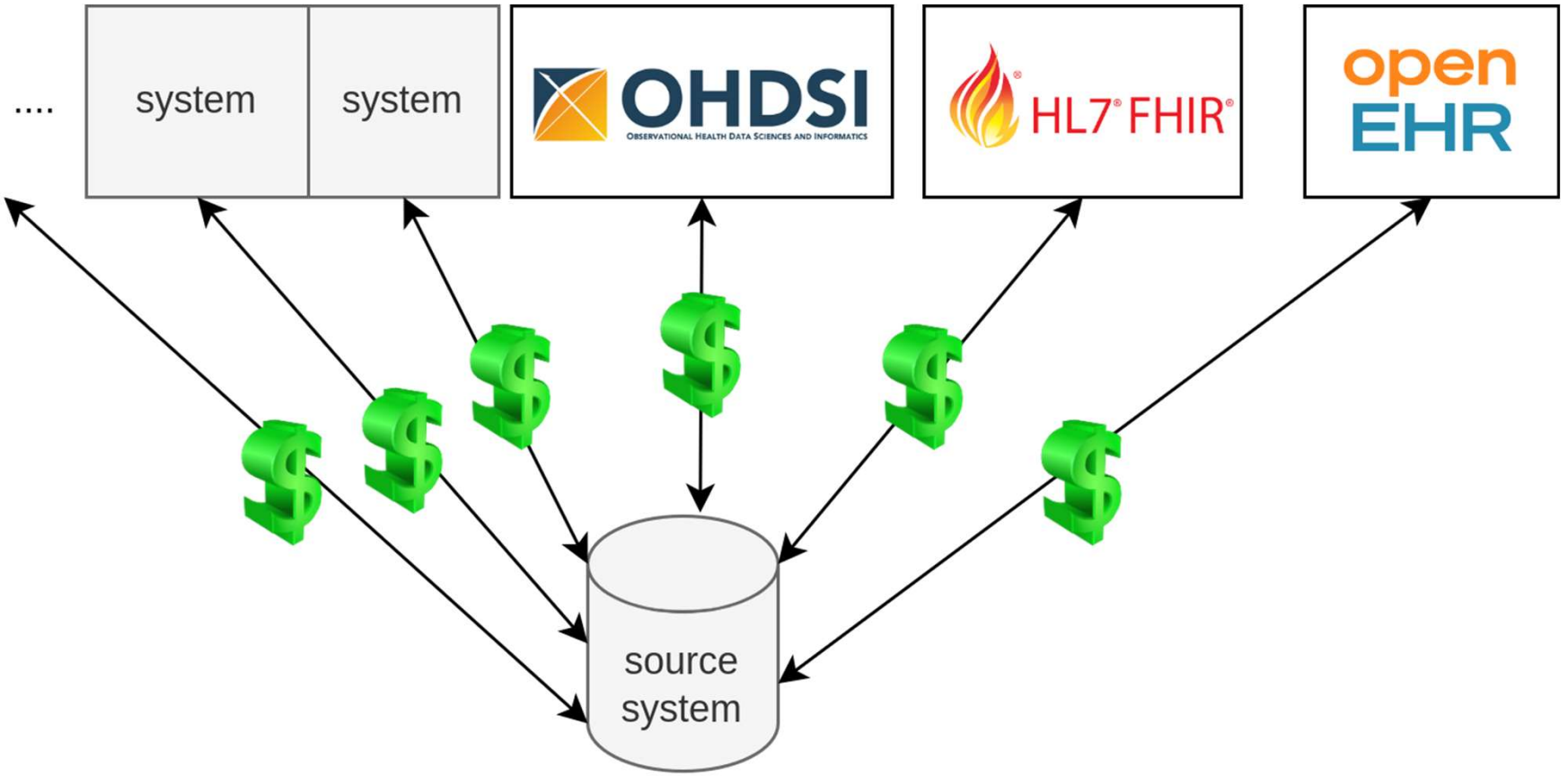

Applications, Region, Outside world
Exchange
for openEHR systems
openEHR
Profiles, Implementation Guides
separated from Clinical Data Repository
tied to exchange
CSD
QEDm
KDS
AU Core
VIPP
International Patient Summary
PGO, MedMij
MHD
ZiBs
...
EEHRxF
BgZ
SDC
US Core
...
FHIR Facade
attractive to innovation
use-case driven
tender & grants compliant
easy to open-up to (regional) access
HL7® FHIR®
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
HL7® FHIR®
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**

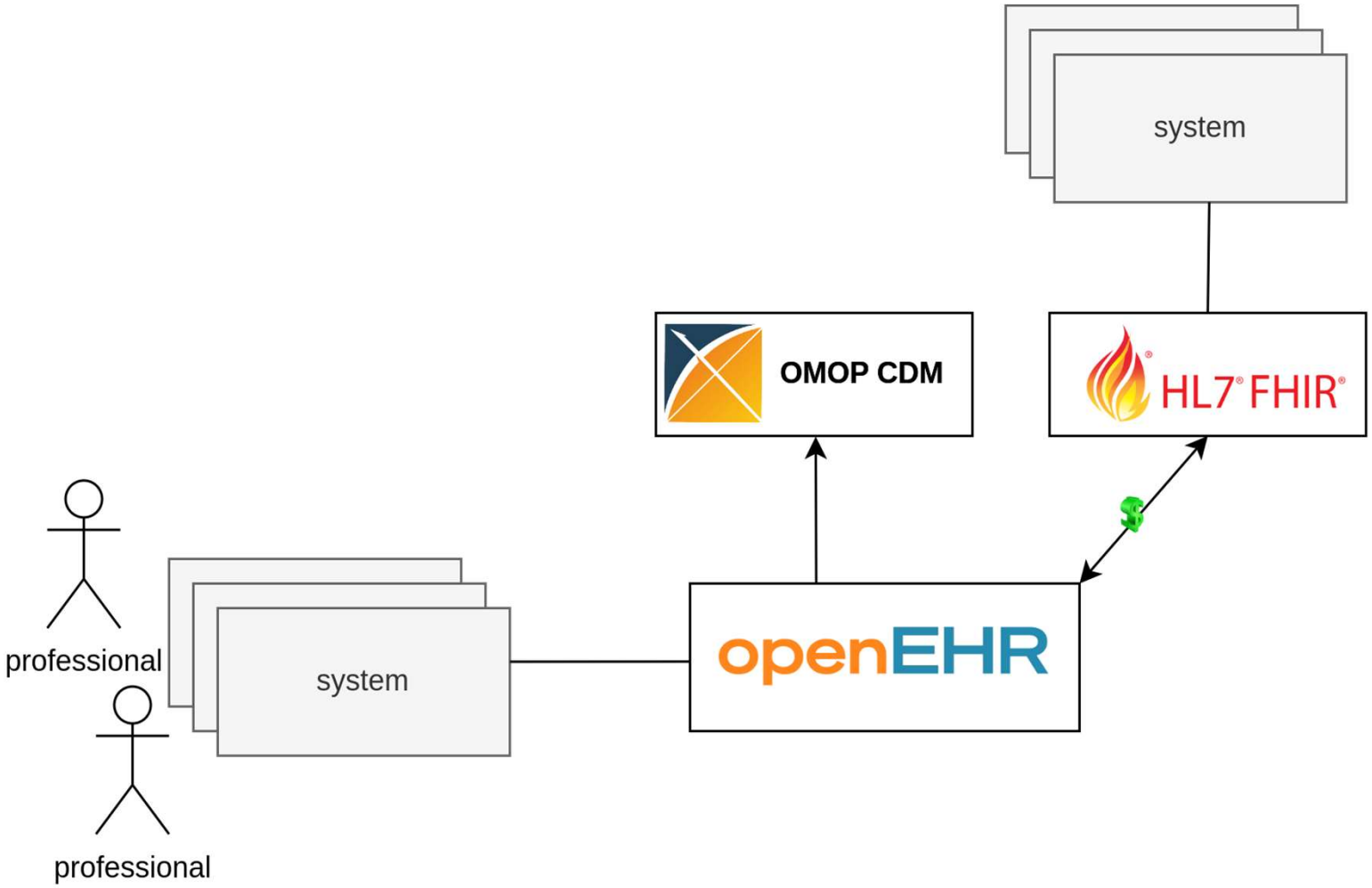
BIH Berlin Institute of Health @Charité

Before



BIH Berlin Institute of Health @Charité

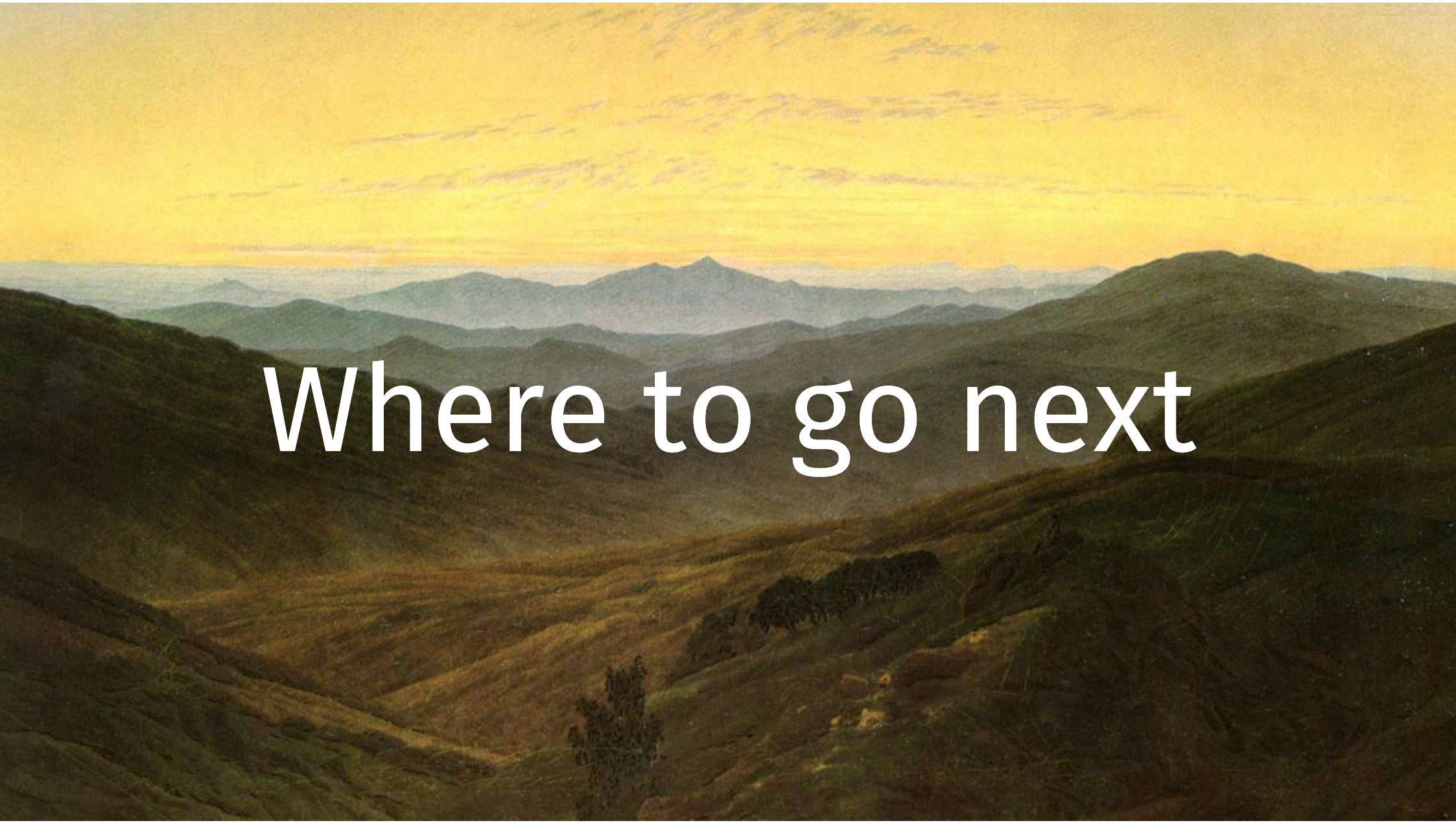
Result



BIH Berlin Institute of Health @Charité

Interoperability

Original image source: CSI Miami, CBS Studios

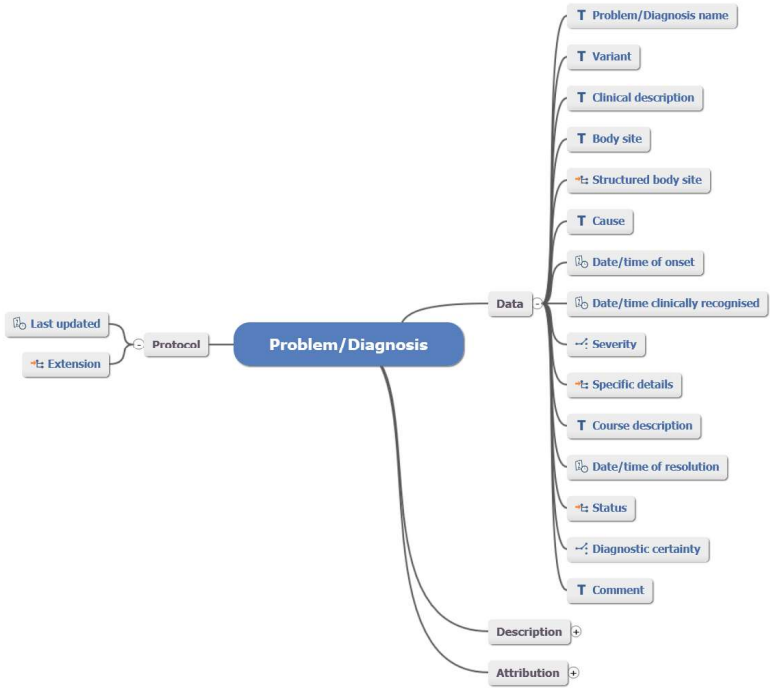

Where to go next

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 ...

www.bihealth.org

severin.kohler@charite.de

/severinkohler