MEDINFO23

8 – 12 JULY 2023 | SYDNEY, AUSTRALIA

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Structured Queries to AQL: Querying OpenEHR Data Leveraging a FHIR-based Infrastructure for Federated Feasibility Queries

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AIDH IMIA

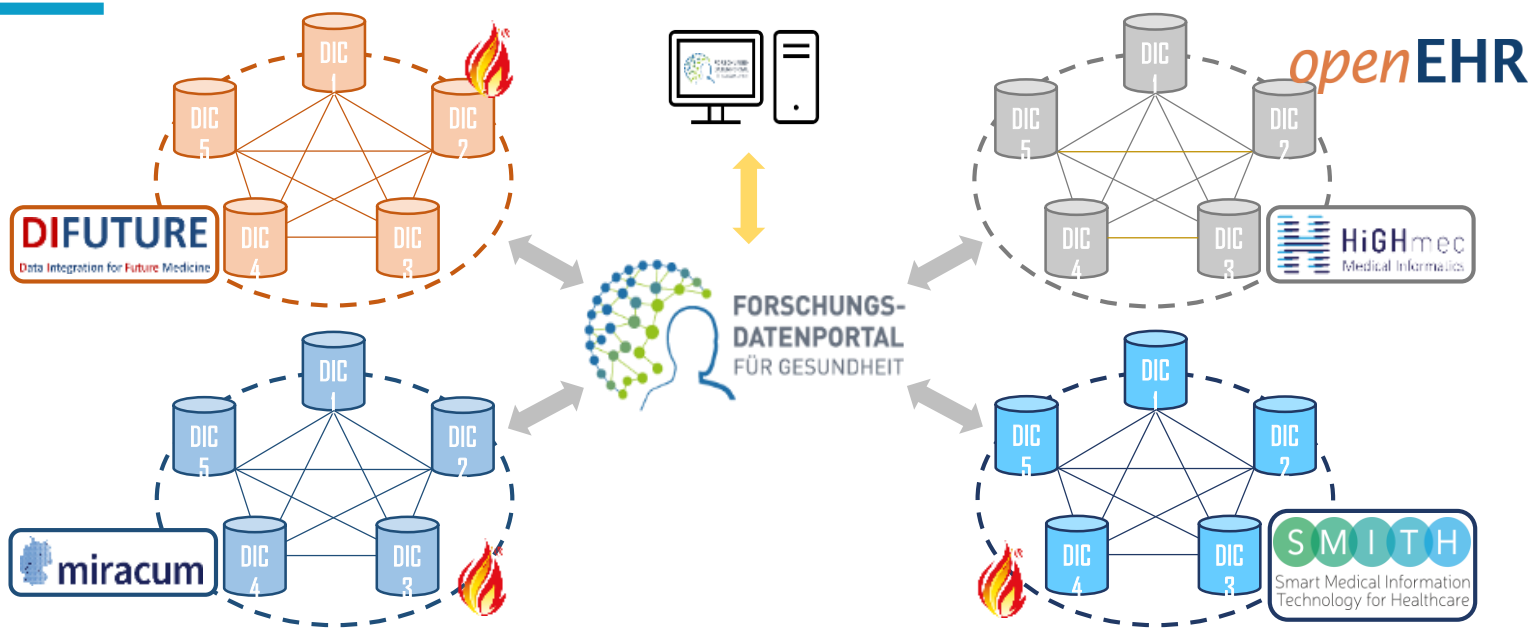
Medical Informatics Initiative

- Making routine data available for research to help detect, treat, and prevent diseases more effectively.
- Establishing Data Integration Centers for researchers
  - Responsible for rendering routine data.
  - Serve as data warehouses: collect, standardize, and make healthcare data available.
  - Promote efficient, secure cross-institutional data sharing.
- Development of the central platform for researchers, FDPG (Forschungs Daten Portal Gesundheit)

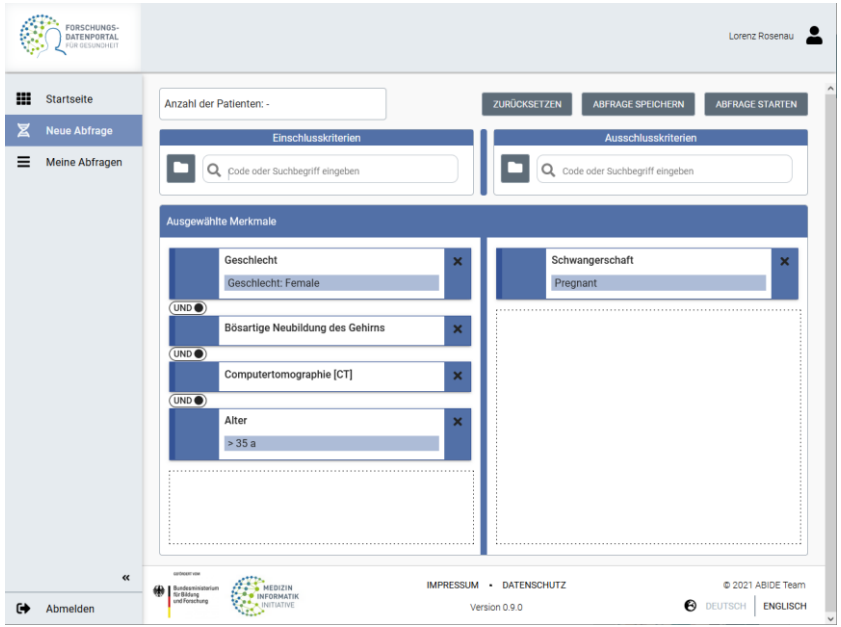
Core data set

- Development & implementation of a shared data model for all German university hospital sites.
- Enables seamless & interoperable data exchange.
- Datamodel agnostic modeling in ART-DÉCOR serves as base for FHIR Profiles and OpenEHR Templates
- Defined elements represent patients, their conditions, laboratory values, medications, consent information, associated specimens and procedures

German Research Data Portal Health



German Research Data Portal Health



Challenge & Goal

The existing solution only works with FHIR instance data

Making the wealth of data in the HighMed OpenEHR CDRs available in the German Research Data Portal Health

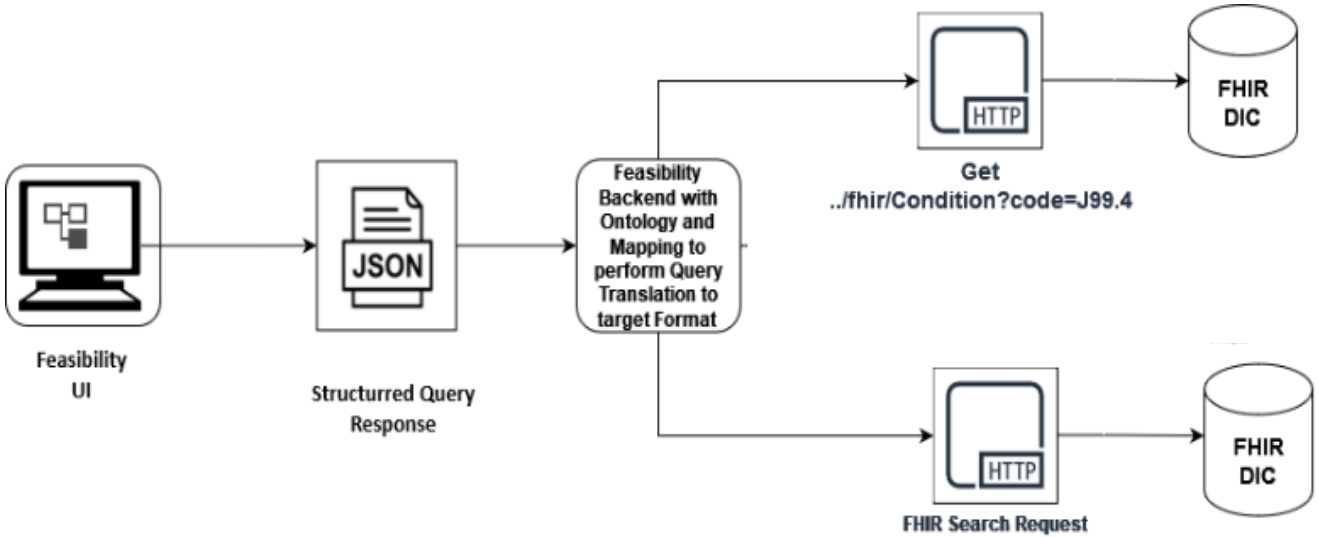
Solution space:

openEHR → ETL → 

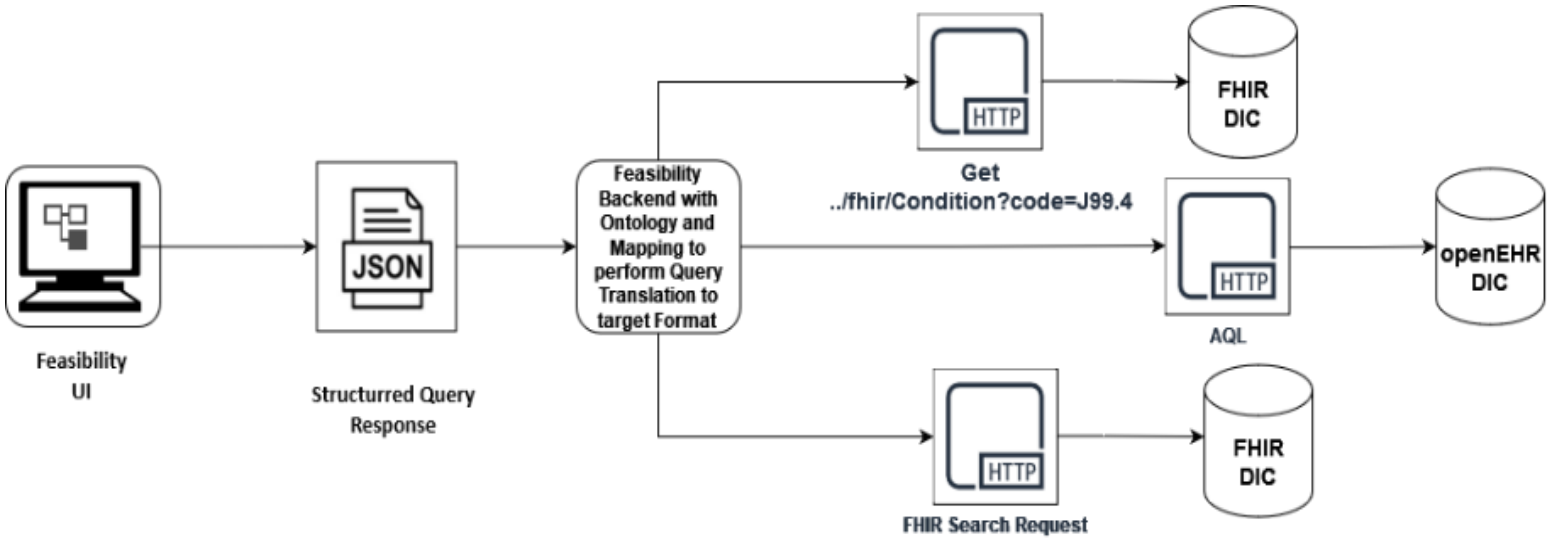
→ AQL

Structured Query

Existing Feasibililty Architecture (simplified)



Feasibility Architecture with AQL support



Structured Query

```
{
    "inclusionCriteria": [                          // Inclusion Criteria are displayed in CNF as an Array of Arrays containing the criteria. Exclusion
criteria are modeled as DNF accordingly
        [
            {
                "termCodes": [                          // termCodes define the concept of the criterion and are modeled similarly to FHIR
CodeableConcept.
                 {
                     "code": "263495000",
                     "display": „Gender",
                     "system": "http://snomed.info/sct"
                 }
               ],
               "valueFilter": {                         // value Filter allows to further restrict the concept. The value Filter has an “is”
relation to the termCode.
                    "selectedConcepts": [                                   // in case the value Filter is a concept, the list of concepts defines the
                        {                                                                                                   // In
addition, quantity criteria can be defined with comparators
                            "code": „male",
                            "display": „Male",
                            "system": "http://hl7.org/fhir/administrative-gender"
                        }
                    ],
                    "type": "concept“,
                     "attributeFilters": [],                                // attribute filters allow to define further restrictions that have an “has”
```

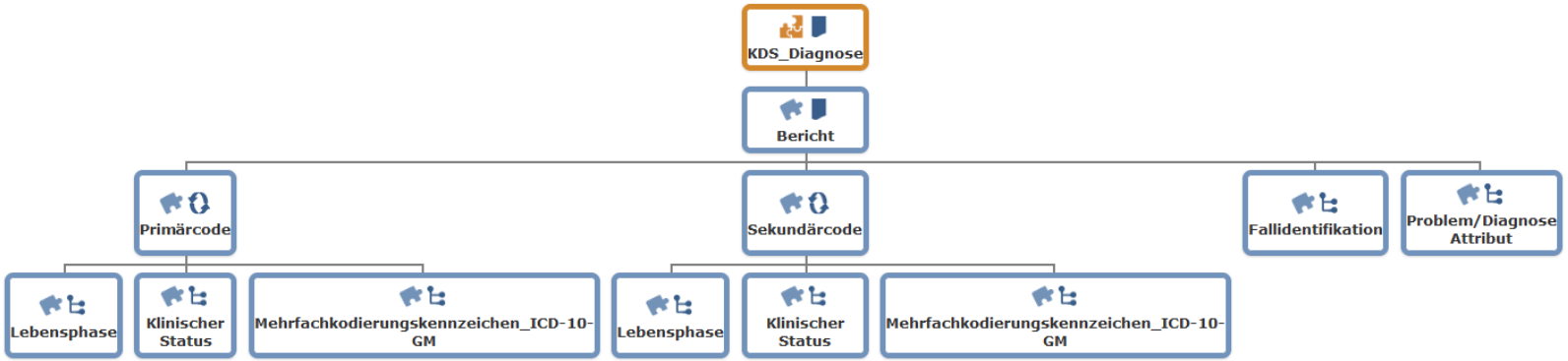
Structured Query


```
{
   "inclusionCriteria": [
      [
         {
            "attributeFilters": [],
            "termCodes": [
               {
                  "code": „G47.3",
                  "display": "",
                  "system": "http://fhir.de/CodeSystem/bfarm/icd-10-gm"
               }
            ]
         }
      ]
   ],
   "version": "http://to_be_decided.com/draft-1/schema#"
}
```

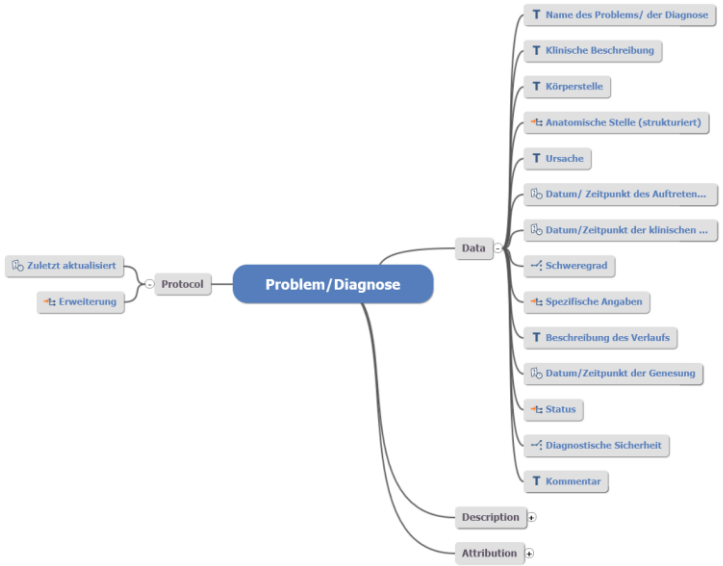
Structured Query


```
{
   "inclusionCriteria": [
      [
         {
            "attributeFilters": [],
            "termCodes": [
               {
                  "code": „G47.3",
                  "display": "",
                  "system": "http://fhir.de/CodeSystem/bfarm/icd-10-gm"
               }
            ]
         }
      ]
   ],
   "version": "http://to_be_decided.com/draft-1/schema#"
}
```

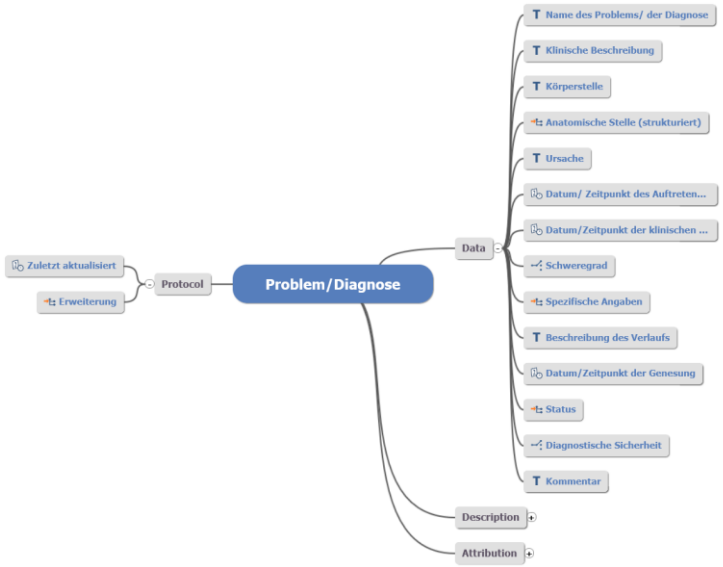
Condition Template



Primary code archetype within Condition



Primary code archetype within Condition



AQL Mapping


```
{
    "key": {
      "code": "G47.3",
      "display": "Schlafapnoe",
      "system": "http://fhir.de/CodeSystem/bfarm/icd-10-gm",
      "version": "2023"
    },
    "openEhrType": "DV_TEXT",
    "termCodePath": "/data[at0001]/items[at0002]/value",
    "termCodePathElements": [
      {
        "archetypeId": "openEHR-EHR-COMPOSITION.report.v1",
        "openEhrType": "COMPOSITION"
      },
      {
        "archetypeId": "openEHR-EHR-EVALUATION.problem_diagnosis.v1",
        "openEhrType": "EVALUATION"
      }
    ]
}
```

AQL Statement

```
SELECT DISTINCT
ehr/ehr_id/value FROM EHR ehr
CONTAINS COMPOSITION report [openEHR-EHR-COMPOSITION.report.v1]
CONTAINS EVALUATION diagnosis [openEHR-EHR-EVALUATION.problem_diagnosis.v1]
WHERE (diagnosis/data[at0001]/items[at0002]/value/defining_code/code_string MATCHES
{'G47.3'} AND
diagnosis/data[at0001]/items[at0002]/value/defining_code/terminology_id/value MATCHES
{'http:fhir.de/CodeSystem/bfarm/icd10-gm'})
```

Summary

- Different healthcare standards use different syntactic and semantic representations of medical data
- If they are based on a common logical model, the heterogeneity is primarily syntactic
- Introducing an intermediate query format utilizing the concepts from the logical model allows:
  - To utilize the same user interface for different data warehouses
  - Translate and enrich the criteria to match the target format

Limitations

- Current implementation only supports value filter („is“-relation)
- Attribute filters (“has”-relation) and time restrictions are not supported yet
- Both common data models must represent the same concepts
- The Operators UNION, MINUS, and INTERSECT are currently not supported by EHRbase
  ➔ A client is required to perform these operations.

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