



liacs

Laden Institute of
Advanced Computer
Science



Universiteit
Leiden

Data Science in

Introduction to the personal health train concept

Policy, legal, political requirements (methodology)

Application of the FAIR principles with the ambition to be certified: (FAIR by design)

PHT reference IT architecture:
about data visiting stations and institutional data points

Project plan focus (minimal viable products)

algoritme reist langs databronnen

Design of a FAIR digital data health infrastructure in Africa for COVID-19 reporting and research - Reisen - 2021 - Advanced Genetics - Wiley Online Library

Course Objectives

Getting started

Applying the FAIR principles to data in a hospital: challenges and opportunities in a pandemic | medRxiv

Specific Objectives

<https://www.go-fair.org/fair-principles/>

Pioneer Program - GO FAIR Foundation

Learn how to realistically plan a project that is limited by time and resources, use project planning tools and practice team-work, using tools to optimize interdisciplinary teamwork

https://en.wikipedia.org/wiki/Minimum_viable_product

Insight in the relevance of data curation for quality data analytical processes and the advantages and limitations of methods based on machine-readable and semantic web-based approaches

Studying of relevant literature and documentation on o GDPR-requirements for data-processing o FAIR-guidelines

<https://gdpr.eu/>

Acquisition of practical skills related to tools that relate to data curation according to FAIR- and GDPR-based processes, such as CEDAR template development, SparQL, deidentification, unique identifiers and facets of FAIR-based data curation

<https://www.fairdatapoint.org/>

Have increased awareness of the real-life settings of data science challenges and the relevance of context and stakeholders for the development of solution

Course Objectives

General Objectives

- **Learning:** To have knowledge of the GDPR and FAIR requirements and their application for data science architectures on data acquisition and - analytics and processes for data science and learn about different applications
- **Competences:** To evaluate a data science problem and to assess feasible approaches towards a solution within the boundaries of minimum criteria for quality
- **Skills:** To exercise new techniques relevant to FAIR Data curation and acquire different toolsets for planning a data-science project and to know how to use these, and to practice skills of presentation, innovation research, interviews and writing.

FAIR Data Science

FAIR Data Science

“FAIR Data Science” is a collaboration with LUMC, Philips and Kampala International University (KIU). Findable, Accessible, Interoperable and Reusable (FAIR) Data is the next generation of ethical data stewardship for sciences and services.

FAIR-data provides a vision of building the Internet of FAIR Data and Services based on machine-readable federated data.

The network is established in nine African countries to create FAIR interoperable patient data held in residence.

The machine-readable data can be visited over the internet with permission being linked to data governance in place where data is produced. FAIR-data is compliant with the EU GDPR.

FAIR also stands for federated AI-Ready. Global ethical data strategies provide a basis for the creation of diverse quality data, which is a key concern for the development of relevant AI

Personal Health Train

| Fieldlab 2 | | 1 |
|------------------------------------|---|---|
| Name | PHT | |
| Organisation | LUMC | |
| Mentor | Olzhas Aldabergenov; Erik Flikkenschild | |
| Contact details | olzhas.aldabergenov@gmail.com e.flikkenschild@lumc.nl | |
| Description of the problem | Deployment of International localised CEDAR software for FAIR Data Production | |
| Skills to be acquired and required | modeling | |
| Degree of challenge | size/volume of the challenge | |
| Number of Team members | TBD | |

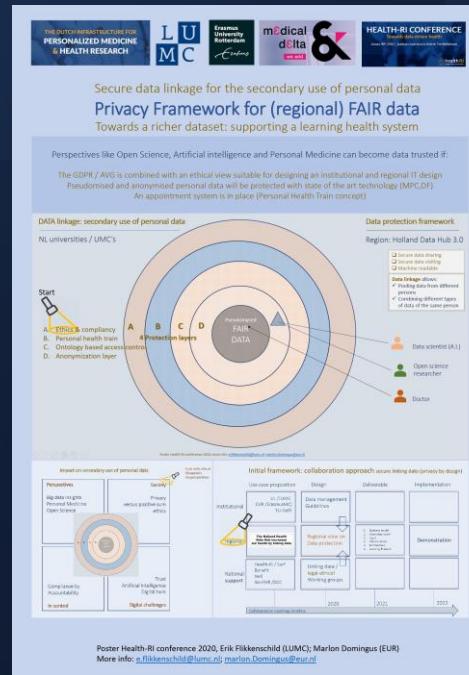
| Fieldlab 1 | | 11 |
|------------------------------------|---|----|
| Name | PHT | |
| Organisation | LUMC | |
| Mentor | Erik Flikkenschild | |
| Contact details | Erik Flikkenschild <e.flikkenschild@lumc.nl> | |
| Description of the problem | Develop a basic architecture with requirements and specifications for a PHT in LUMC | |
| Skills to be acquired and required | modeling | |
| Degree of challenge | size/volume of the challenge | |
| Number of Team members | TBD | |

LIACS Field lab 1 & 2

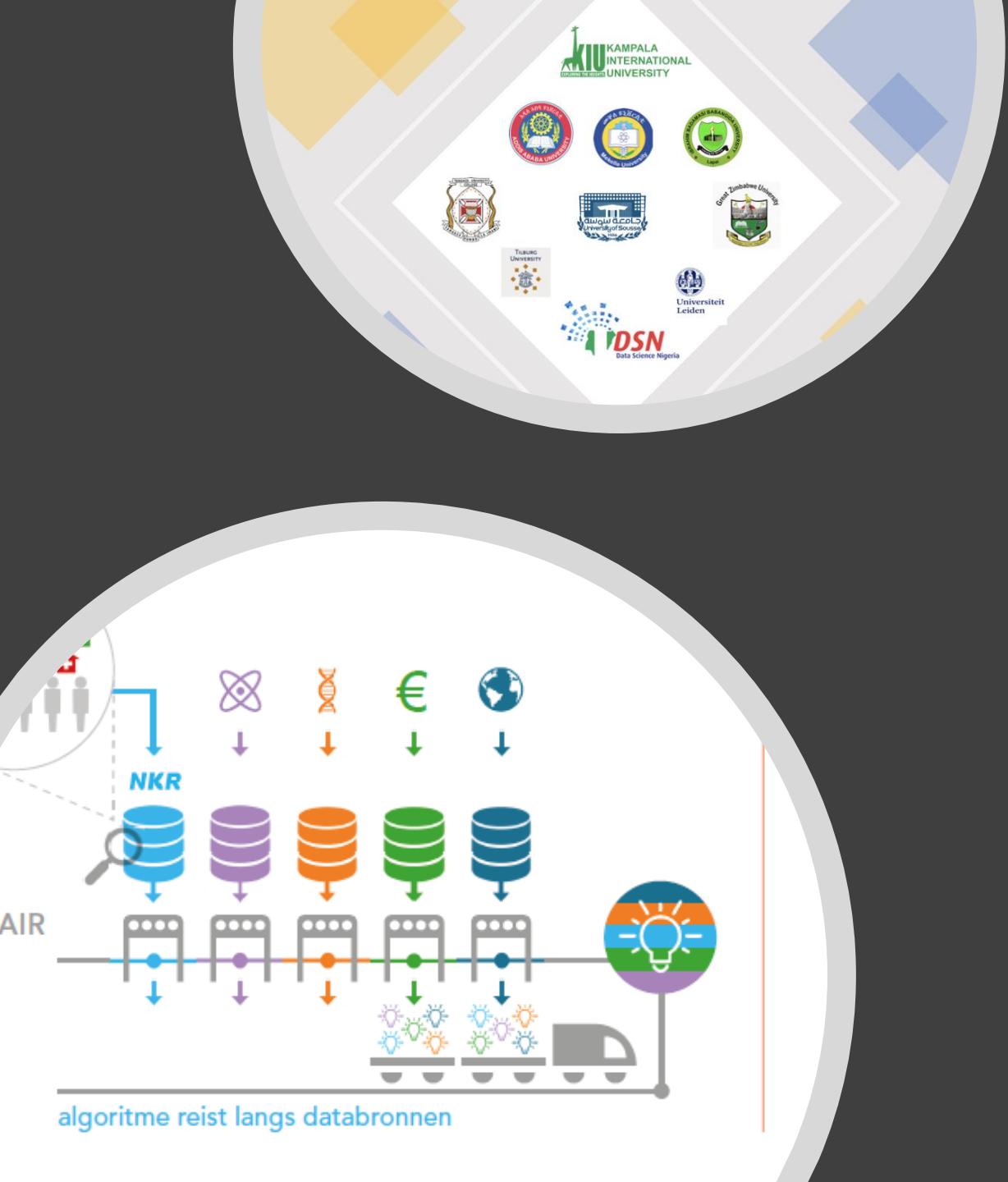


Personal Health Train

| Fieldlab 6 | |
|------------------------------------|---|
| | 5 |
| Name | Permission architecture for federated algorithmic queries and deidentification |
| Organisation | VODAN-A |
| Mentor | Putu |
| Contact details | Dhr. Putu Hadi Purnama Jati (putu.hadi.purnama.jati) <putu.hadi.purnama.jati@umail.leidenuniv.nl> |
| Description of the problem | authorisation and security automated contracts |
| Skills to be acquired and required | automated contracts and authorisation architecture |
| Degree of challenge | innovation |
| Number of Team members | TBD |



LIACS Field lab 6



PHT Agenda

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LUMC roadmap



Findable Accessible Interoperable Reusable

<https://www.go-fair.org/fair-principles/>

LUMC
LEIDS UNIVERSITAIR MEDISCH CENTRUM

Strategiestudie Research ICT 2018
Merkbare Researchwaarde

© Illustratie: Simone Houtman

Jeanine Houwing-Duistermaat (Medische Statistiek en Bio-informatica),
child (Directoraat ICT), Marielle Kroon (Directoraat Onderzoek)

<https://www.lumc.nl/res/att/1364304>

Towards FAIR 2.0 (2021-2023)

Data trust = a secure IT infrastructure + access control



HEALTH-RI CONFERENCE
Empowering Personalized Medicine & Health Research

THEATER DE FLIJN, AMERSFOORT
THE NETHERLANDS

Secure data linkage for the secondary use of personal data
Privacy Framework for (regional) FAIR data
Towards a richer dataset: supporting a learning health system

Perspectives like Open Science, Artificial Intelligence and Personal Medicine can become data trusted if
The GDPR / AVG is combined with an ethical view outcome for designing an institutional and regional IT design
Personalised and anonymised personal data will be protected with state-of-the-art technology (MPC, DP)
An appointment system is in place (Personal Health Train concept)

DATA linkage: secondary use of personal data
NI universities / UMC's

Data protection framework
Region: Holland Data Hub 3.0

Start

A Protection layer

B Personal health train

C Domains based access control

D Anonymization layer

E Data science (AI)

GDPR

Data linking

Trusted FAIR data

Technology

ethics

Data Licenses; contracts

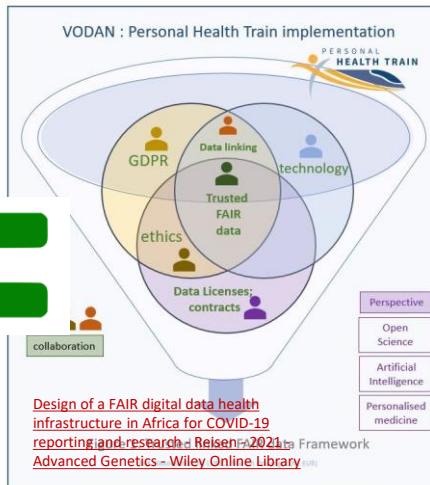
Perspective

- Open Science
- Artificial Intelligence
- Personalised medicine

<https://www.health-ri.nl/sites/healthri/files/2020-01/2020%20Health-RI%20Conference%20Abstract%20Book.pdf> (abstract)



Phase 2 VODAN Africa - LUMC



[Proof of Concept developed by VODAN Africa and Asia - GO FAIR \(go-fair.org\)](#)

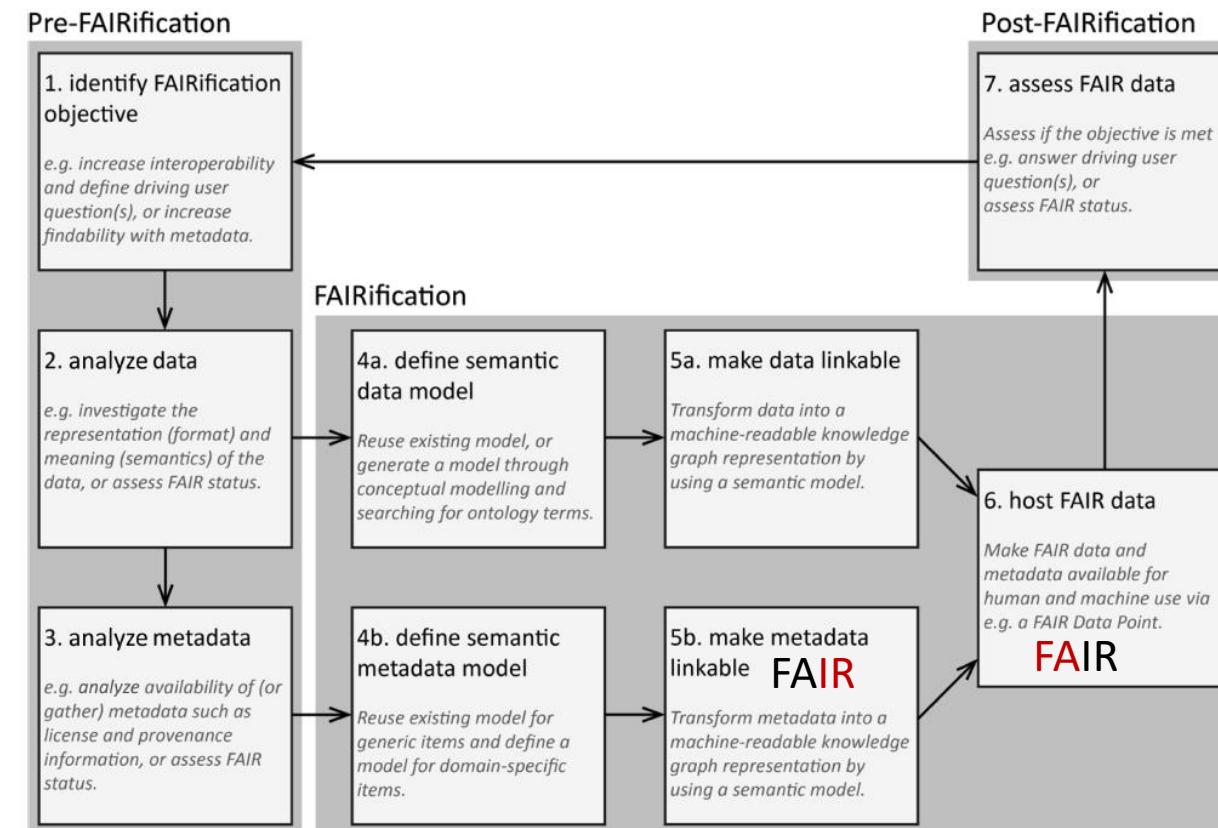
A Generic Workflow for the Data FAIRification Process

Community
FAIRification
workspace

Annika Jacobsen^{1†}, Rajaram Kaliyaperumal¹, Luiz Olavo Bonino da Silva Santos²,
Barend Mons^{1,2}, Erik Schultes², Marco Roos¹ & Mark Thompson¹

¹Leiden University Medical Center, Leiden, 2333 ZA, The Netherlands

²GO FAIR International Support & Coordination Office (GFISCO), Leiden, The Netherlands



anDREa
Policies &
Procedures

VRE/DRE

Home

Security Manifesto

▼ CIA / BIV

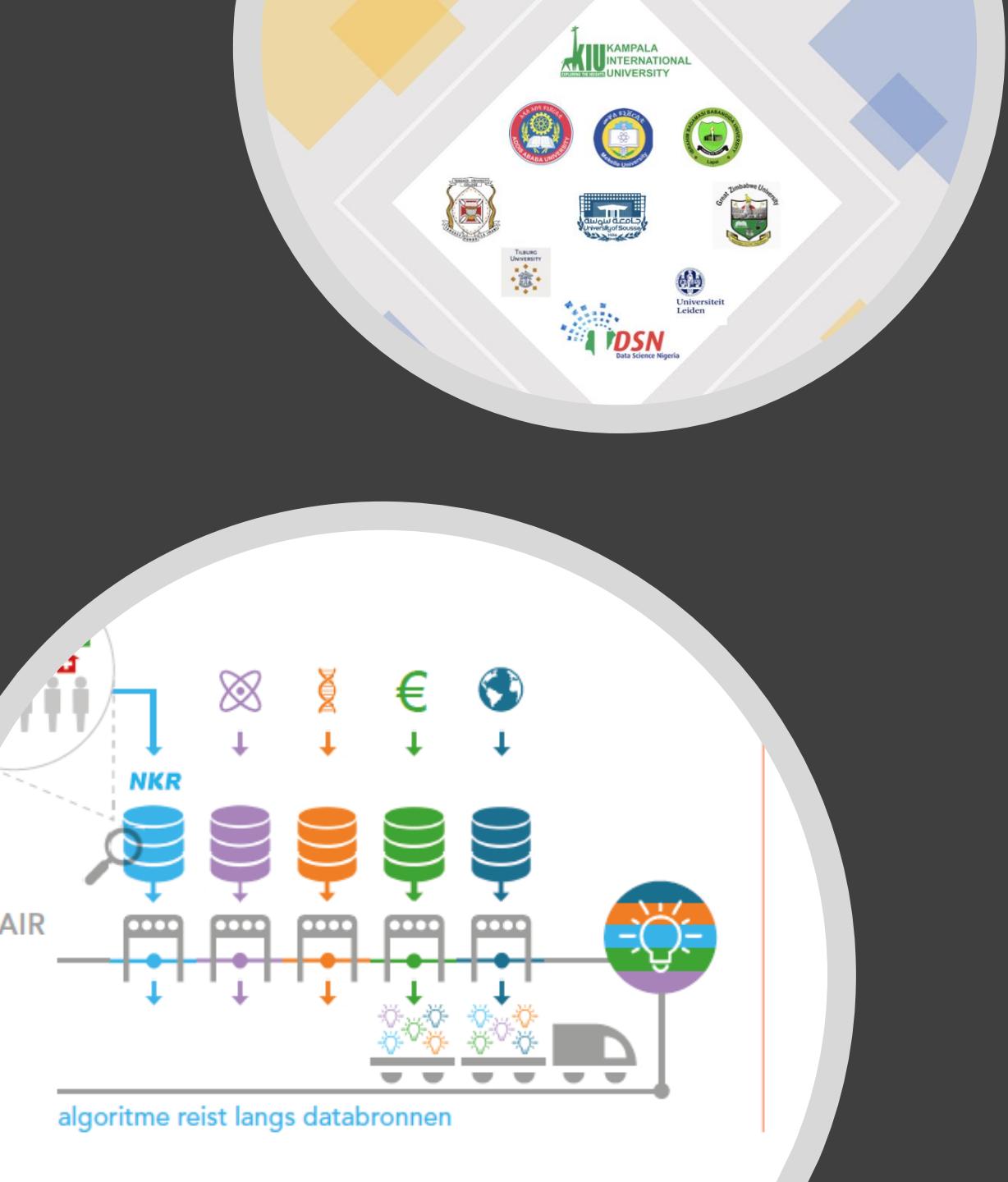
ISO 27001

NEN 7510

GDPR Compliance
Assessment

DPIA

Privacy Shield



Introduction to the personal health train concept

Policy, legal, political requirements (methodology)

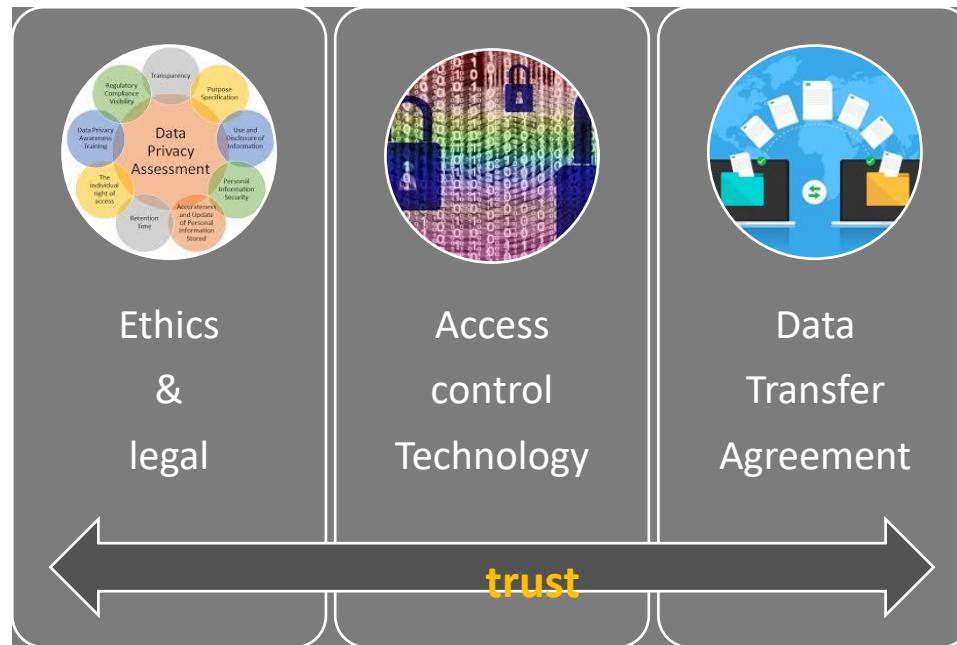
Application of the FAIR principles with the ambition to be certified: (FAIR by design)

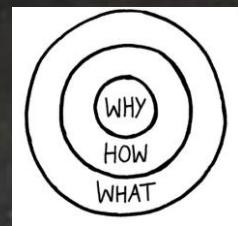
PHT reference IT architecture:
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VODAN-Africa / LUMC approach





Is the data visiting scope national?
EU?
Global?

Trust

- Artificial Intelligence?
- Personalised Medicine?
- Federating learning (horizontal)
- Multi party computation?
- Are there ethical considerations?

How becomes my institute
GDPR proof?

And the consortium?

Do we have mutual
data licences
Understanding?

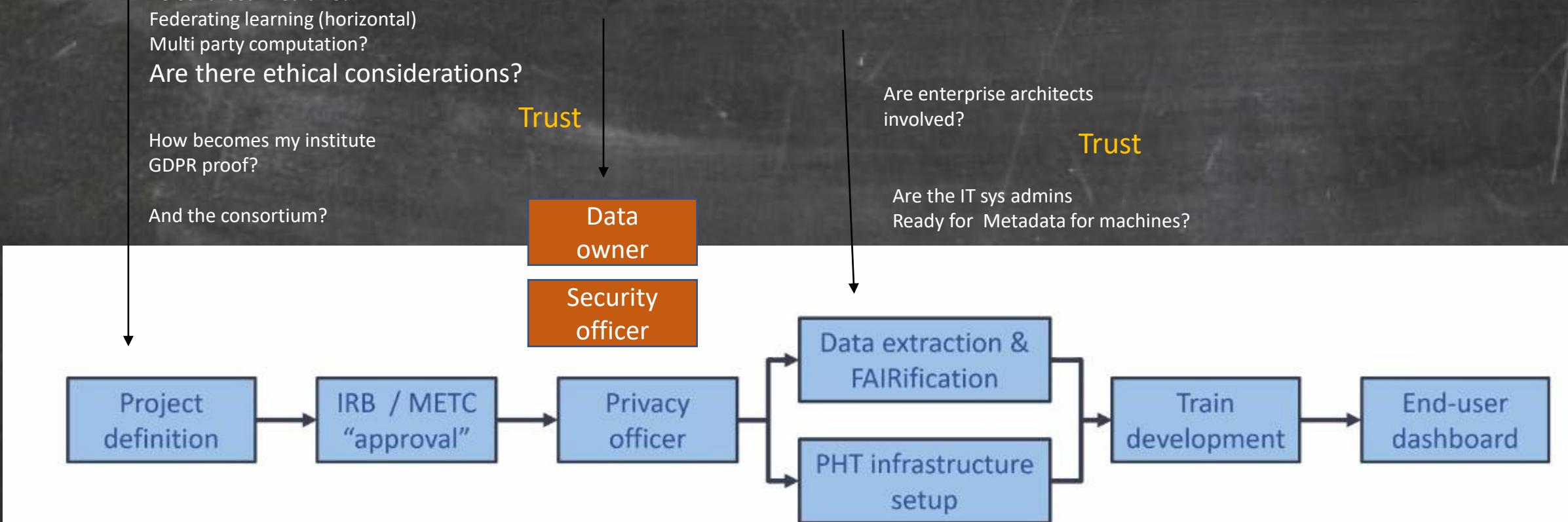
Is the Data Competence (Integration) Centre
Ready to make data FAIR?

Trust

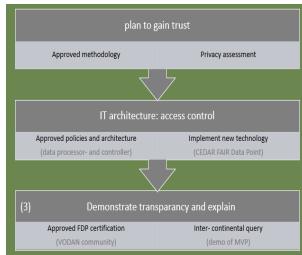
Are enterprise architects
involved?

Trust

Are the IT sys admins
Ready for Metadata for machines?



About methodology



Step 1: involve board of directors and privacy decision makers

THE DUTCH INFRASTRUCTURE FOR PERSONALIZED MEDICINE & HEALTH RESEARCH

LUMC **Erasmus University Rotterdam** **m&edical d&elta** **HEALTH-RI CONFERENCE**

Secure data linkage for the secondary use of personal data

Privacy Framework for (regional) FAIR data

Towards a richer dataset: supporting a learning health system

Perspectives like Open Science, Artificial intelligence and Personal Medicine can become data trusted if:

The GDPR / AVG is combined with an ethical view suitable for designing an institutional and regional IT design
Pseudomised and anonymised personal data will be protected with state of the art technology (MPC,DF)
An appointment system is in place (Personal Health Train concept)

DATA linkage: secondary use of personal data

NL universities / UMC's

Start

A. Ethics & compliancy
B. Personal health train
C. Ontology based access control
D. Anonymization layer

4 Protection layers

Pseudomised FAIR DATA

Data protection framework

Region: Holland Data Hub 3.0

- Secure data sharing
- Secure data visiting
- Machine readable

Data linkage allows:

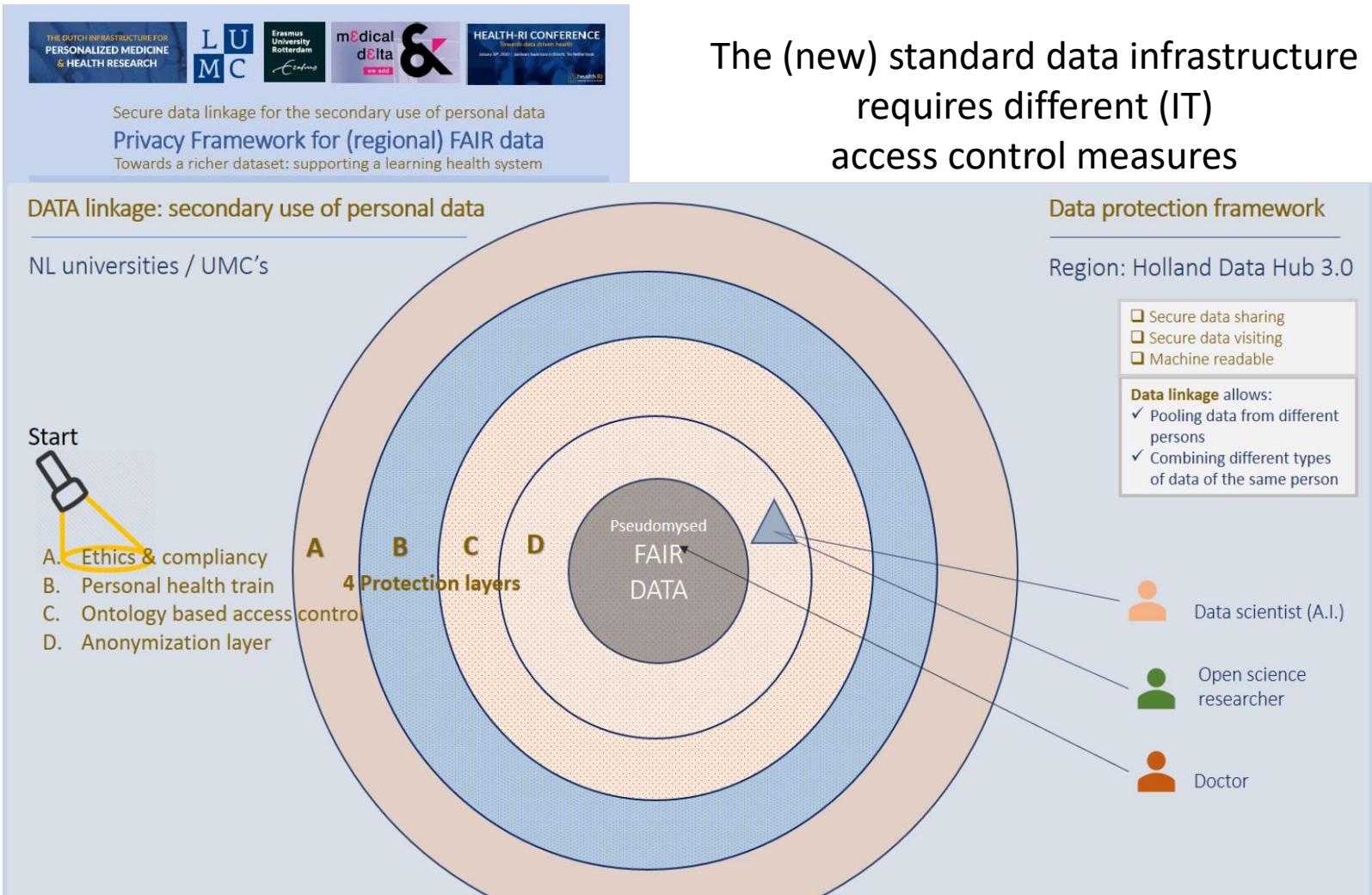
- ✓ Pooling data from different persons
- ✓ Combining different types of data of the same person

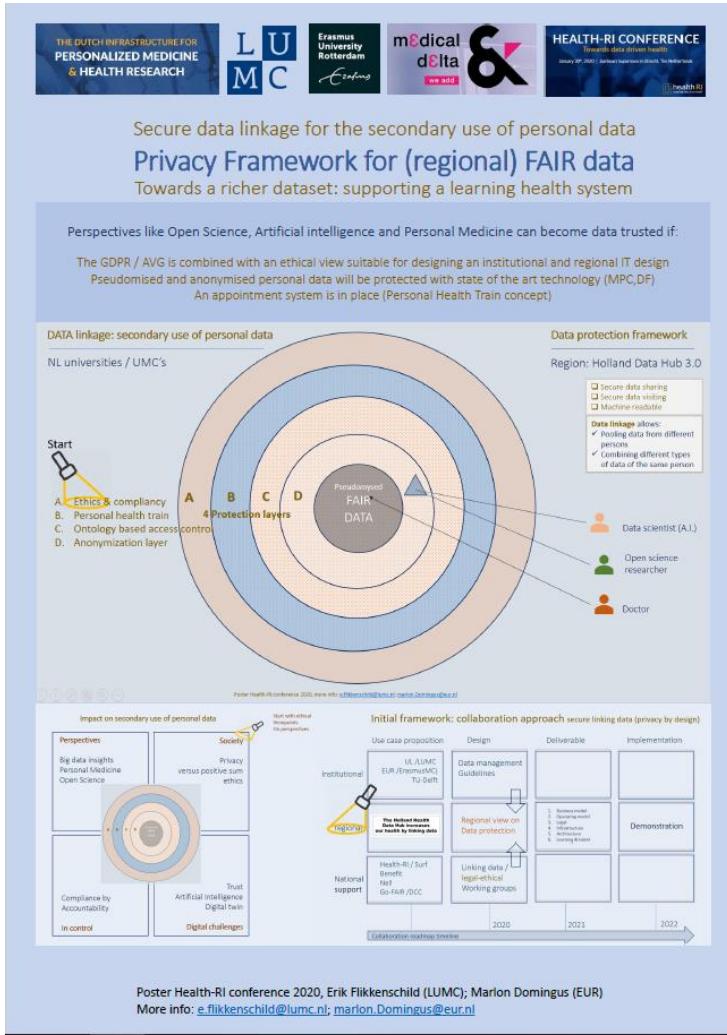
Data scientist (A.I.)

Open science researcher

Doctor

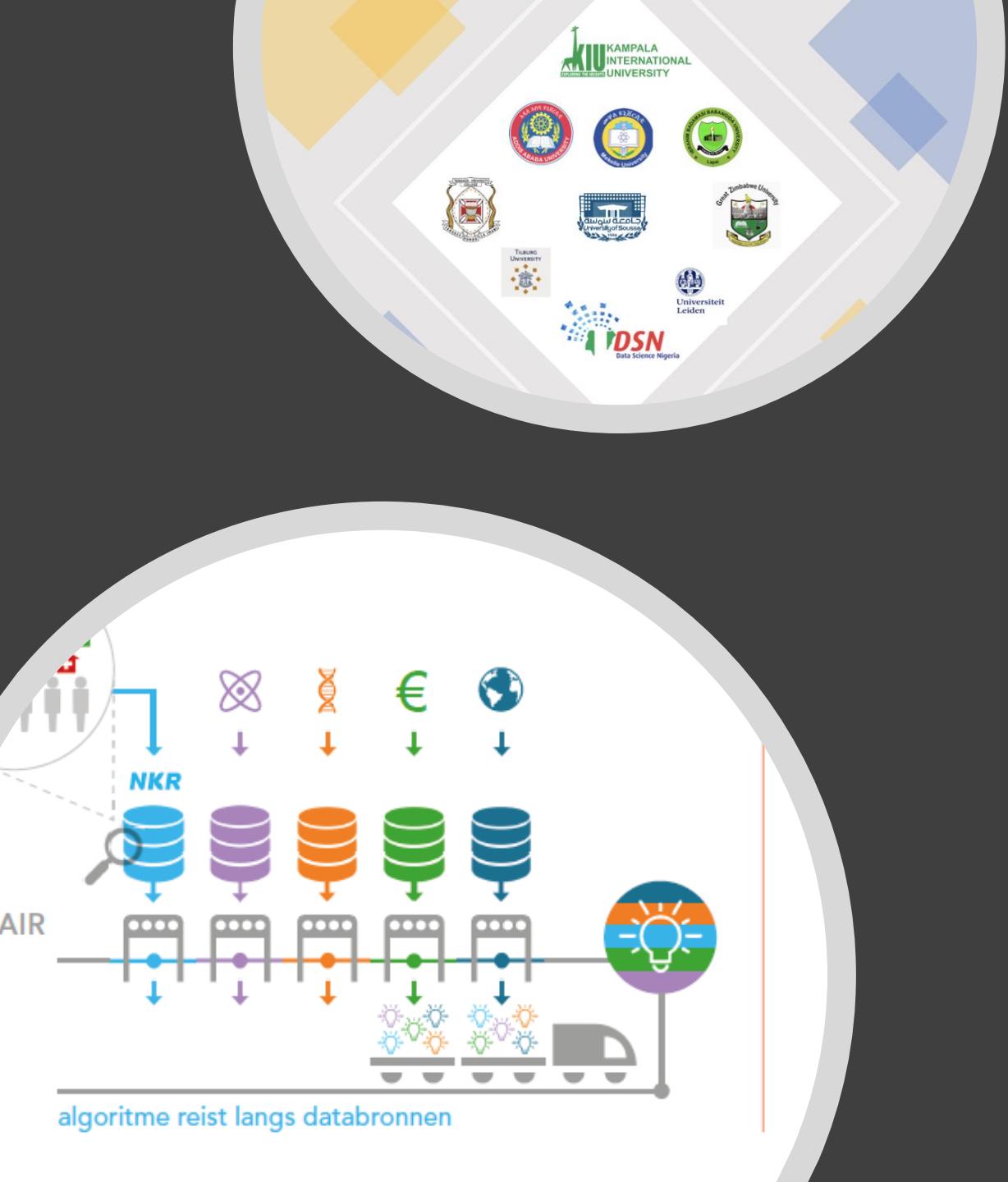
Poster Health-RI conference 2020, Erik Flikkenschild (LUMC); Marlon Domingus (EUR)
More info: e.flikkenschild@lumc.nl; marlon.Domingus@eur.nl





Roadmap

- Ethical review per perspective**
Define the institutional view on the positive sum of a social perspective, gaining the proper balance between common interest (e.g., the patient) against the individual privacy aspects;
- Investigate privacy and ownership concerns**
Use the Privacy Framework for communication purposes with (research) management and institutional policy makers;
- Design the I.T access control architecture**
Anonymity is protected by including 4 access control protection layers in the design (addressing the A in FAIR); e.g., an institution can demand the presence of a technology anonymization layer (Multi party Computation);



Introduction to the personal health train concept

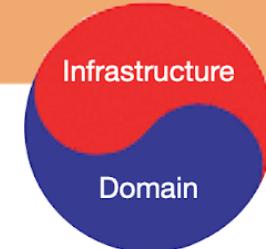
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Box 2 | The FAIR Guiding Principles



To be Findable:

- F1. (meta)data are assigned a **globally unique** and **persistent** identifier
- F2. data are described with rich **metadata** (defined by R1 below)
- F3. metadata clearly and explicitly **include the identifier** of the data it describes
- F4. (meta)data are registered or **indexed** in a searchable resource

To be Accessible:

- A1. (meta)data are retrievable by their identifier using a standardized **communications protocol**
 - A1.1 the protocol is **open, free, and universally implementable**
 - A1.2 the protocol allows for an **authentication and authorization** procedure, where necessary
- A2. **metadata are accessible, even when the data are no longer available**

To be Interoperable:

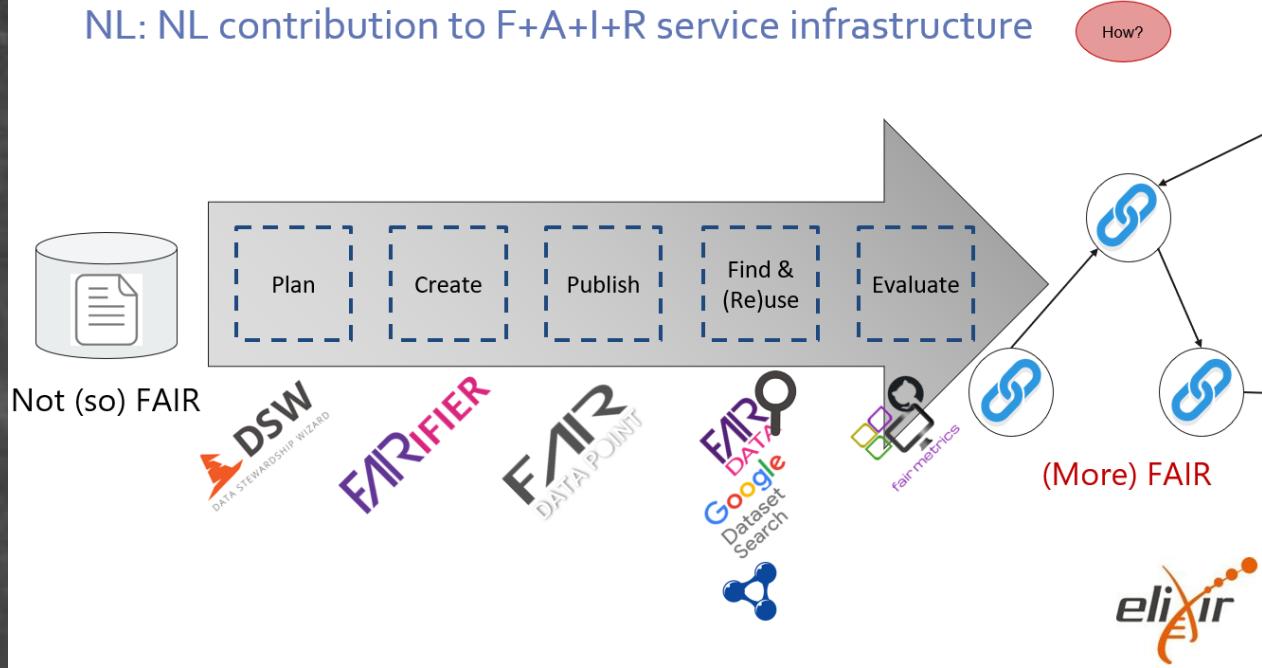
- I1. (meta)data use a formal, accessible, shared, and broadly applicable language for **knowledge representation**.
- I2. (meta)data use **vocabularies** that follow FAIR principles
- I3. (meta)data include **qualified references** to other (meta)data

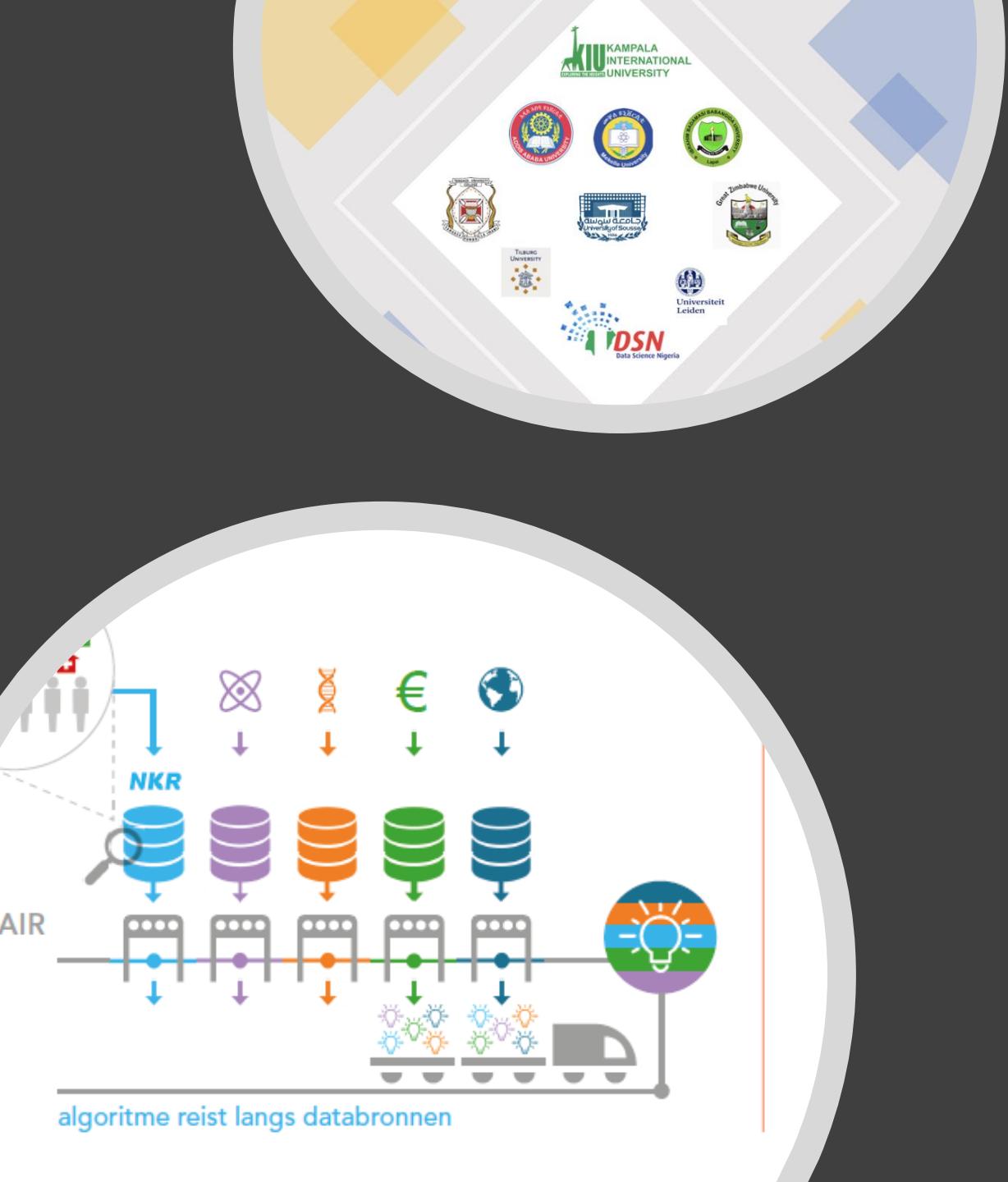
To be Reusable:

- R1. meta(data) are richly described with a plurality of accurate and relevant attributes
 - R1.1. (meta)data are released with a clear and accessible data **usage license**
 - R1.2. (meta)data are associated with detailed **provenance**
 - R1.3. (meta)data meet **domain-relevant community standards**



NL: NL contribution to F+A+I+R service infrastructure





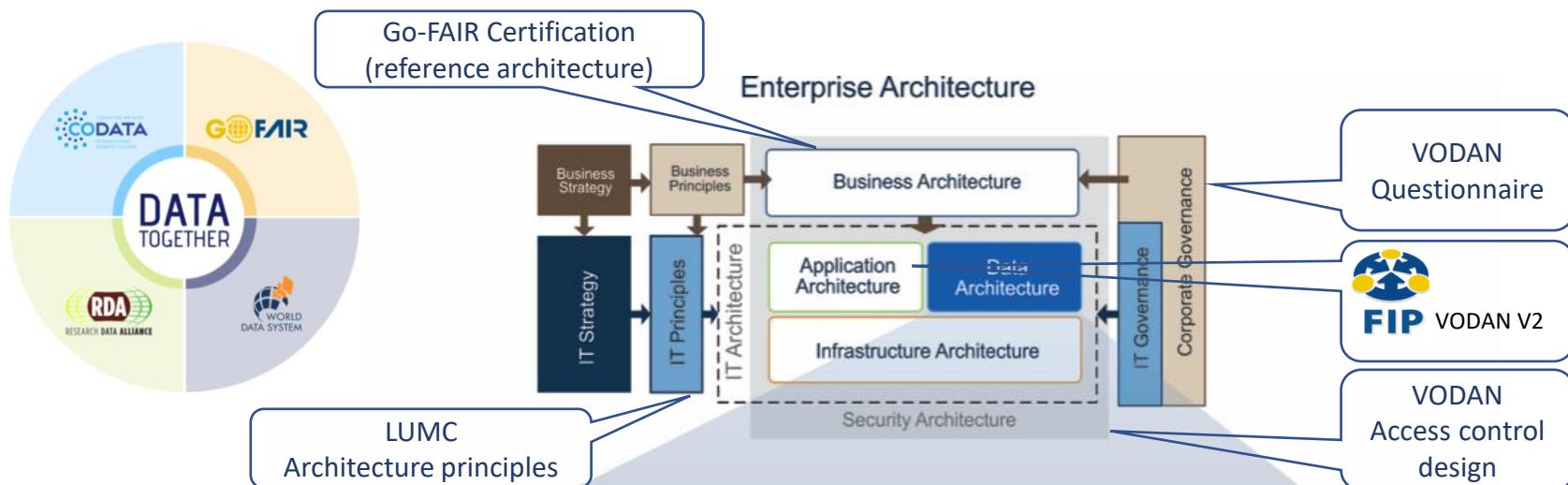
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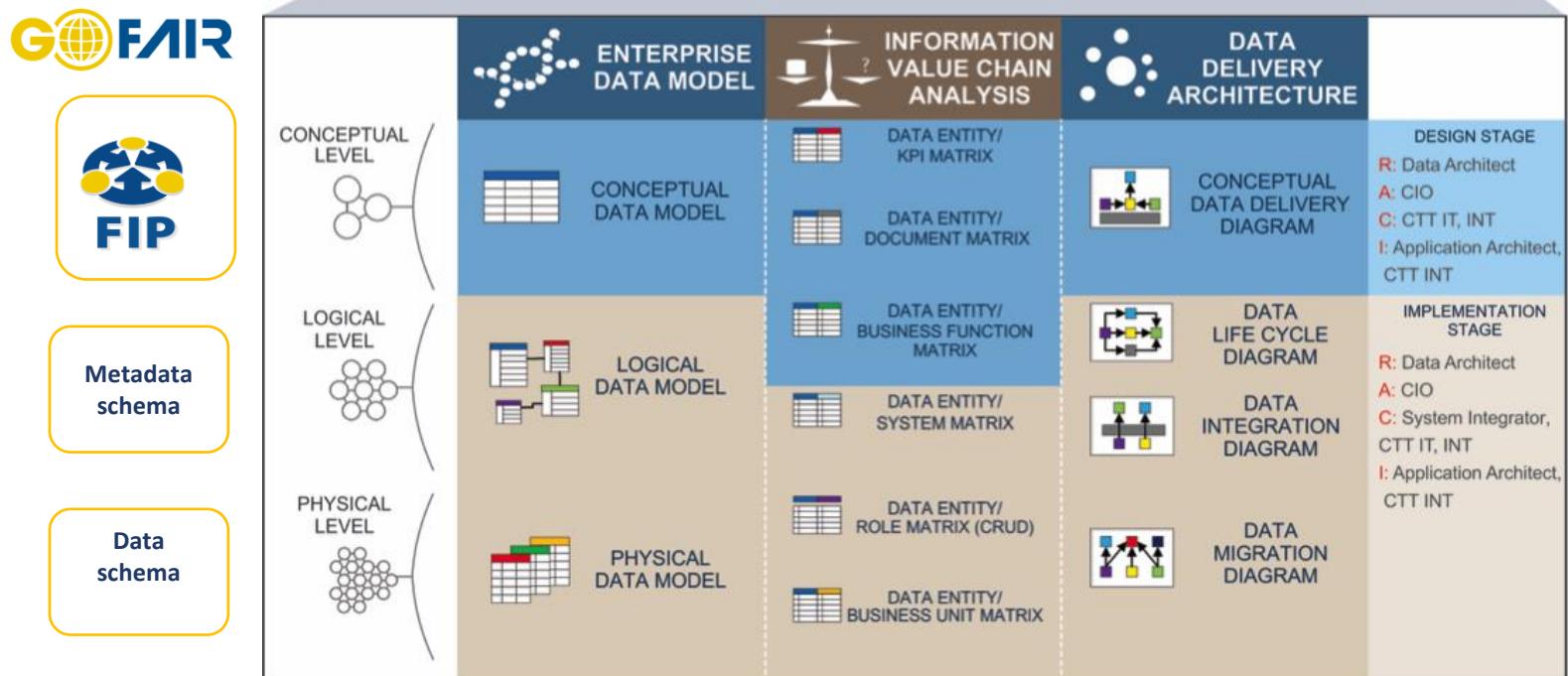
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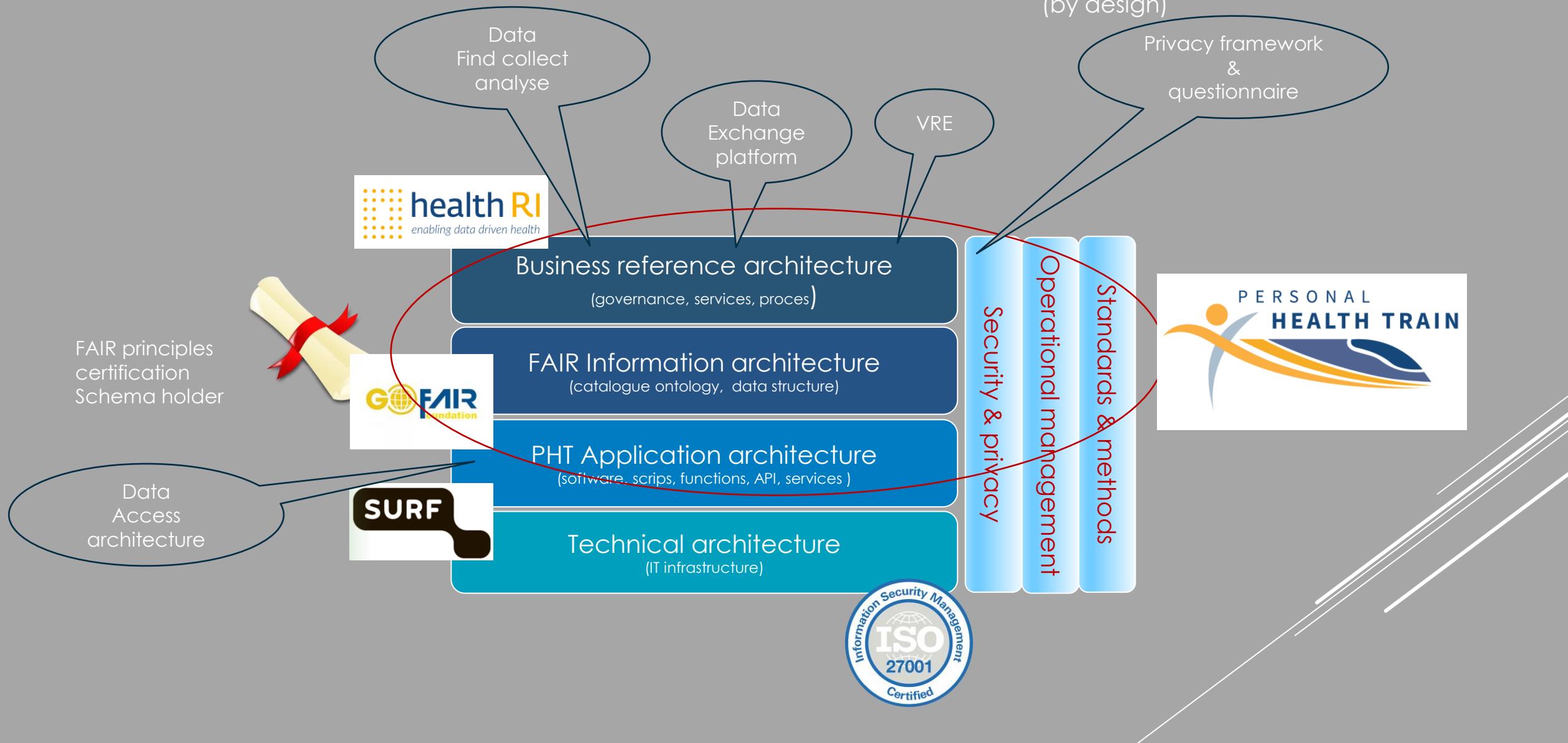


ENTERPRISE DATA ARCHITECTURE

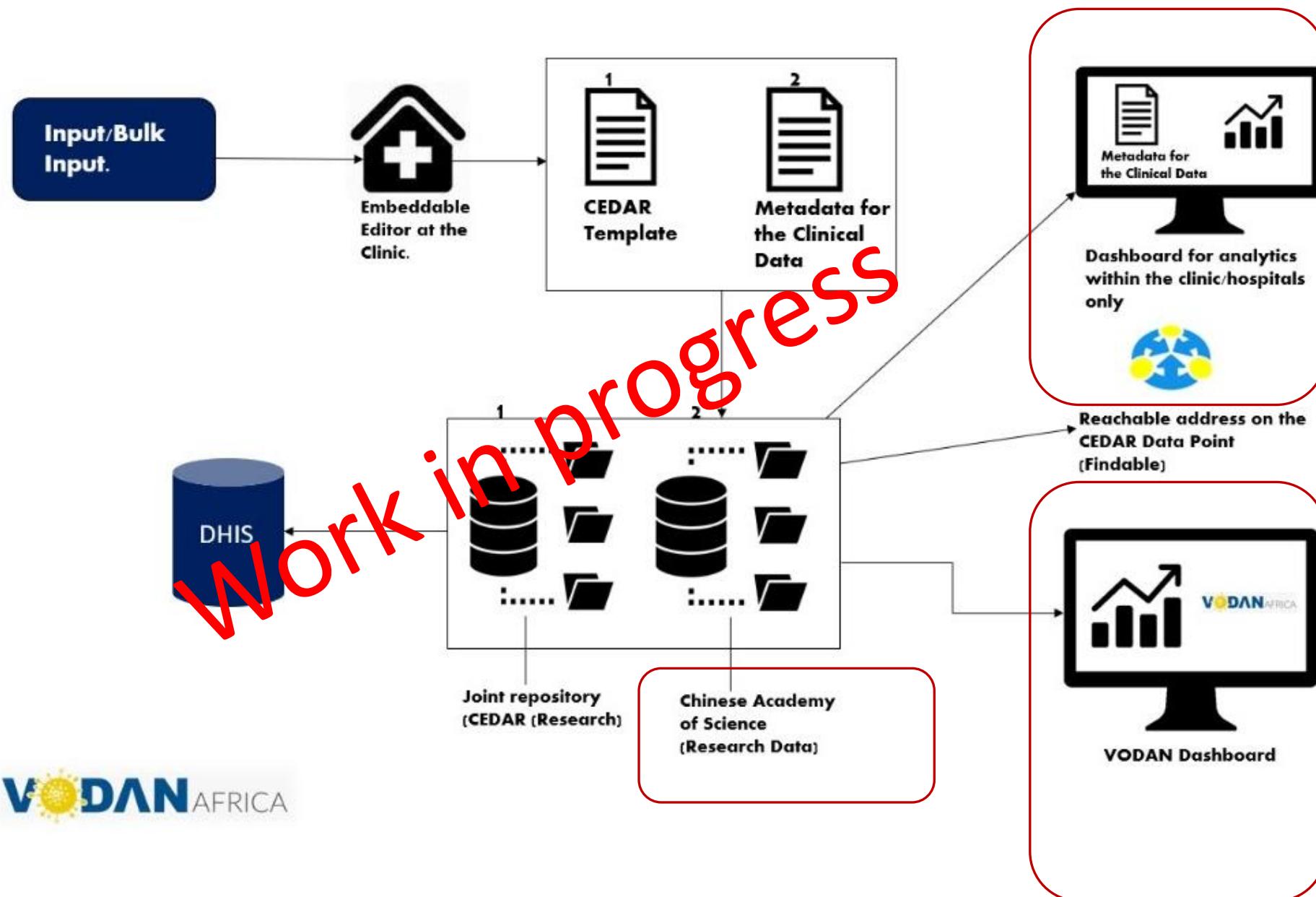


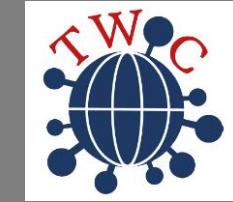
Virus Outbreak Data Network (VODAN)

Integrating FAIR IT services starts with security & privacy (by design)



VODAN access control architecture





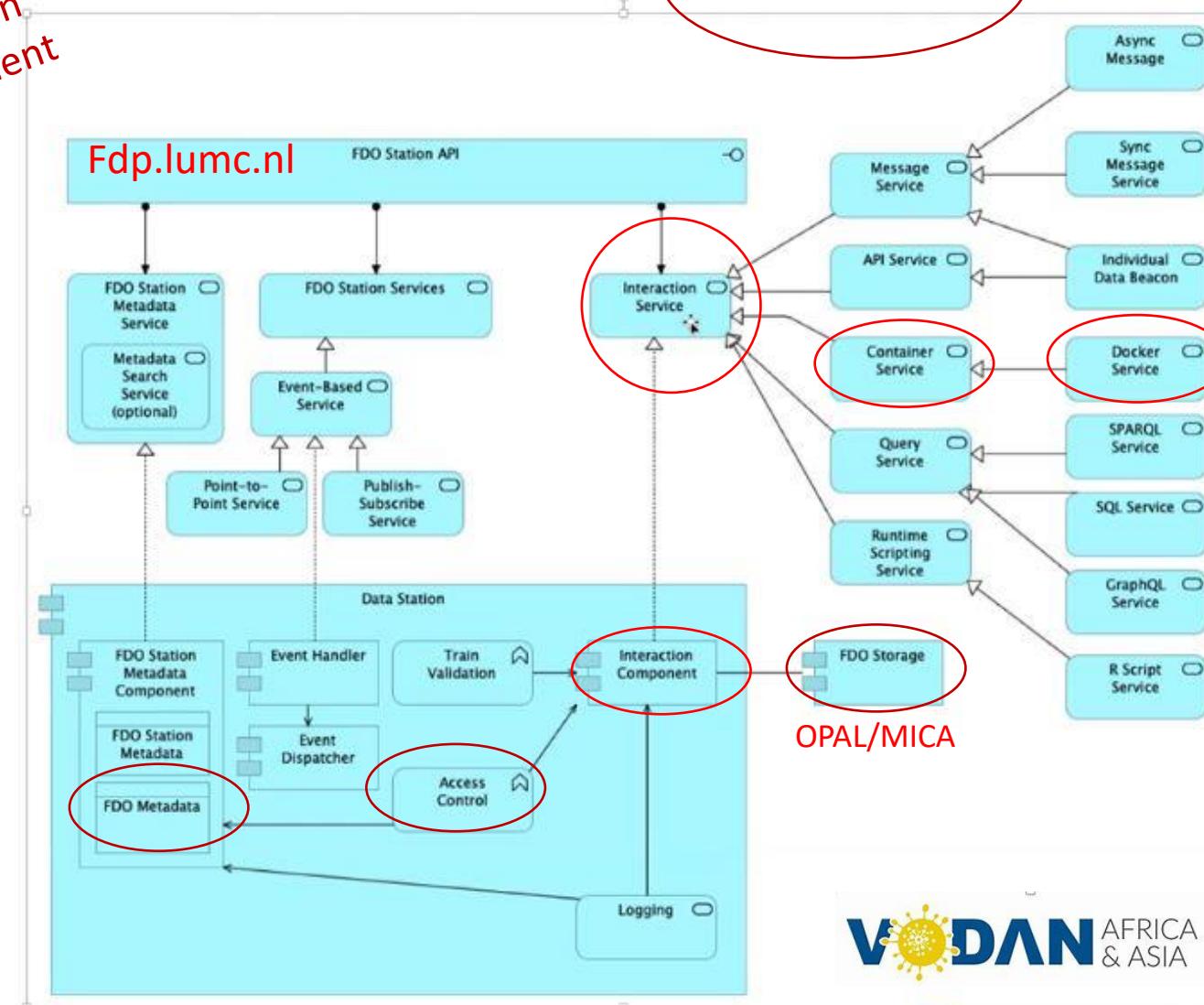
Overview of interaction mechanisms

| Interaction mechanism | Functionality | Security | Compliance | Level of governance required | Complexity |
|--------------------------------|---------------|----------|------------|------------------------------|------------|
| Open SPARQL Endpoint | Medium / High | Low | Low | Low | Low |
| Predefined questions using API | Low | Medium | Medium | Low | Low |
| Validated queries | Medium / High | High | High | Medium | Medium |
| Containerisation | High | High | High | High | High |

Note: the interaction mechanisms do not exclude each other; an open endpoint can be used for open data (e.g. metadata) combined with validated queries or containerisation for the use of data.

Go-FAIR
FAIR Data Train
Certification
development

FDT STATION – SERVICES



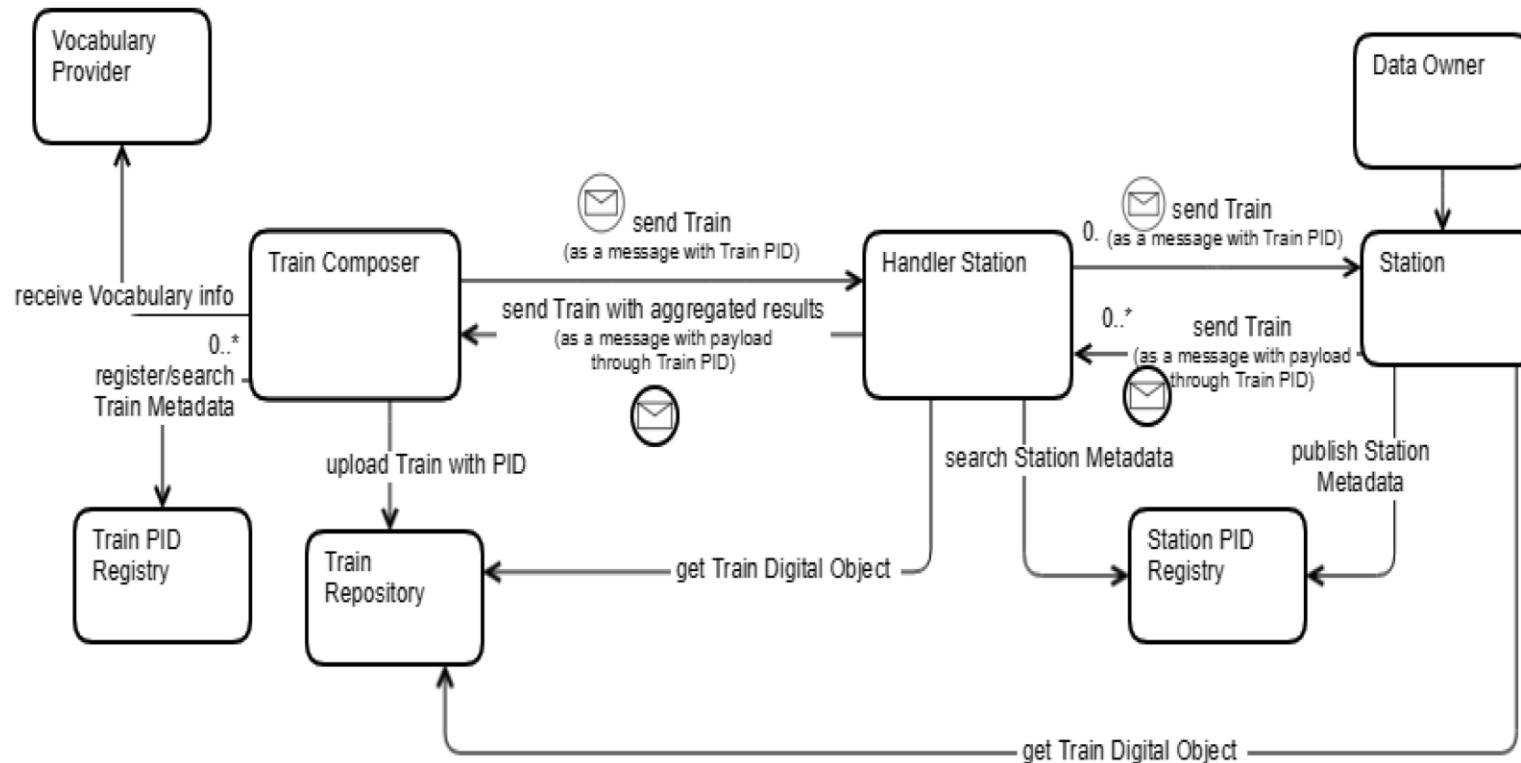
Source : Luiz Olavo Bonino (lead architect Go-FAIR foundation)



Leiden University
Medical Center

Distributed Analytics on Sensitive Medical Data: The Personal Health Train

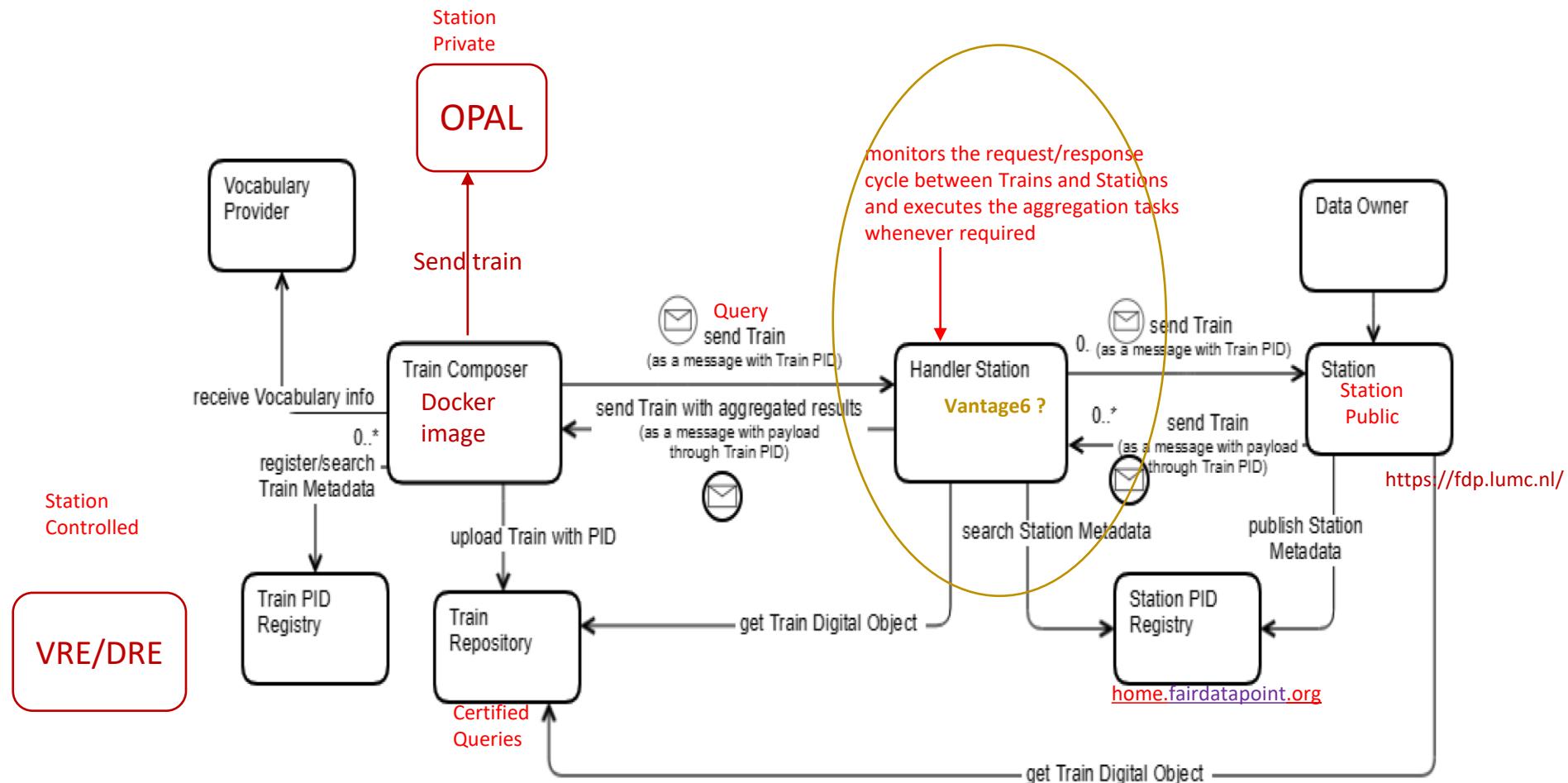
Oya Beyan^{1,2†}, Ananya Choudhury³, Johan van Soest^{3,4}, Oliver Kohlbacher^{5,6,7,8},
Lukas Zimmermann⁷, Holger Stenzhorn⁷, Md. Rezaul Karim^{1,2}, Michel Dumontier⁴,
Stefan Decker^{1,2}, Luiz Olavo Bonino da Silva Santos⁹ & Andre Dekker³

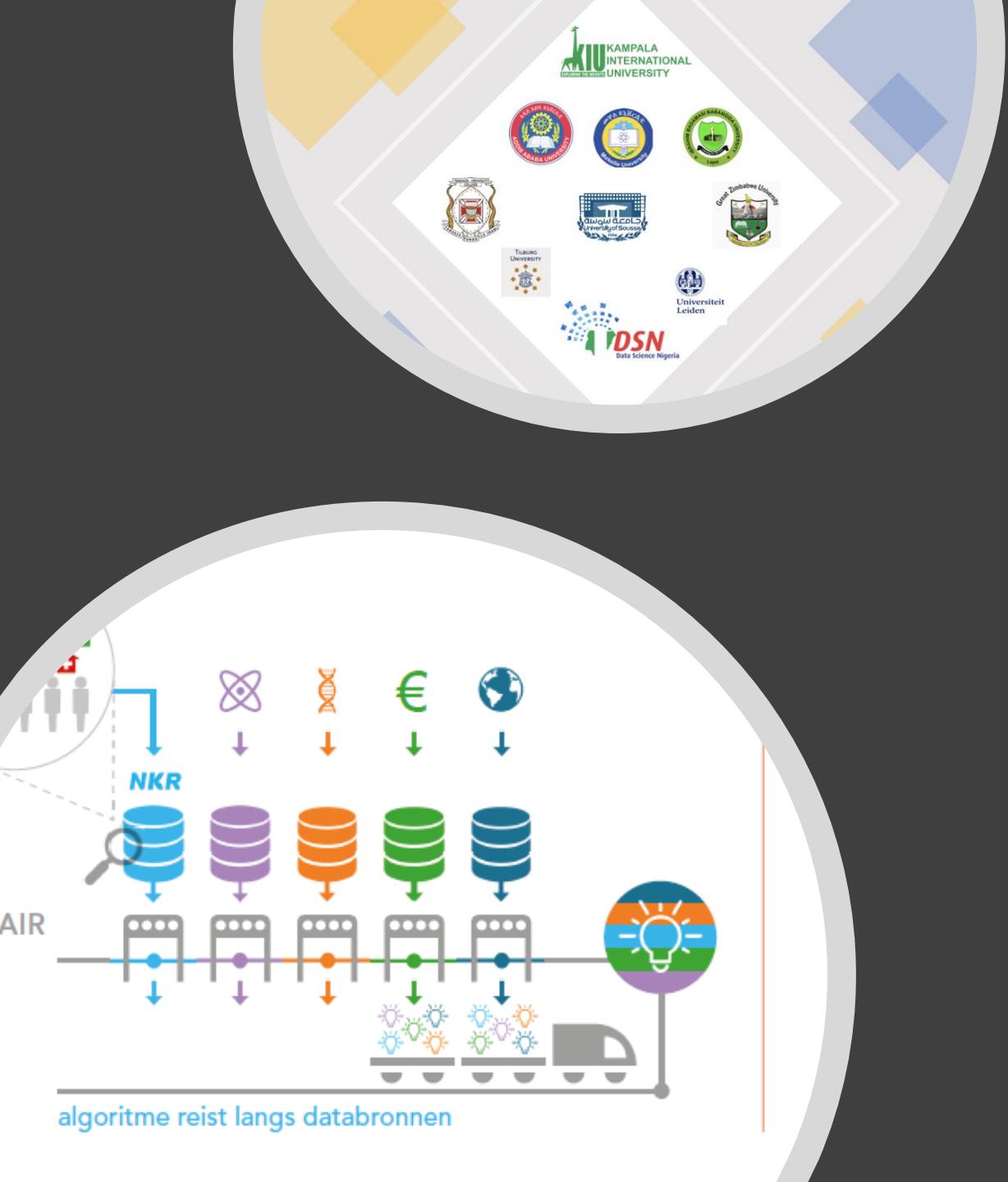


With what
technology to
implement
PHT services?

Distributed Analytics on Sensitive Medical Data: The Personal Health Train

Oya Beyan^{1,2†}, Ananya Choudhury³, Johan van Soest^{3,4}, Oliver Kohlbacher^{5,6,7,8},
Lukas Zimmermann⁷, Holger Stenzhorn⁷, Md. Rezaul Karim^{1,2}, Michel Dumontier⁴,
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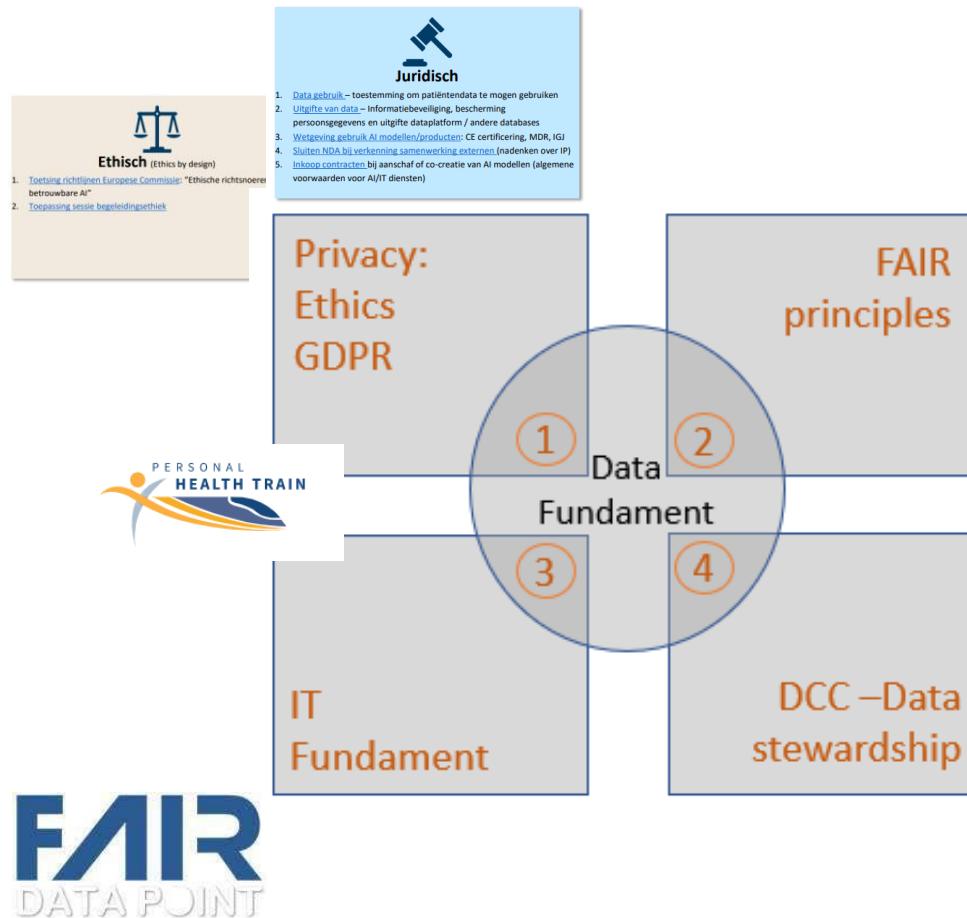
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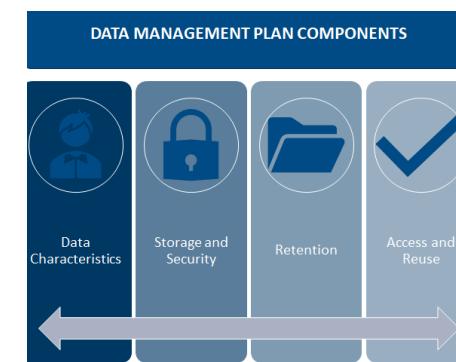
Project plan focus (minimal viable products)

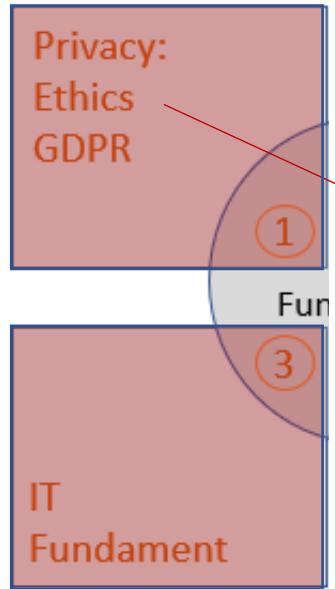


← Communities

Personal Health Train – Distributed Learning Community

People and organizations interested in applying the Personal Health Train concept or distributed learning techniques to health-related topics are working together in the Personal Health Train network. The PHT concept enables health care innovators and researchers to work with health data from various sources.





Data Driven Health: Connect, Share and Reuse

Building a National Health Research Infrastructure for optimal access to knowledge, tools, facilities, health data and samples. For sustainable and affordable personalized medicine and health.



Realisatie lerend zorgsysteem via drie actielijnen in een hub & nodes model



Status building FAIR Data Points and stations Testing grounds:

TWOC / VODAN: access to LUMC synthetic dataset (5 x 1000 patients)

1. VODAN in a box FDP hosts two times 1000 patients (2 separately owned registries)
2. Data in triple store (separate registries protected with named accounts)

VODAN-IN: trusted access to health-care data (presentation Putu Hadi, Aliya Aktau

- ✓ access control requirements methodology used (questionnaire)
- ✓ Architectural decision: use CEDAR FAIR Datapoint with IAA services

questions:

1. What is needed to approve this implementation (Go-FAIR certification scheme)
2. PHT: is federated learning possible using vantage6 container?

presentation Melle Sieswerda (IKNL / LUMC)

IKNL / LUMC collaboration : idea for joined Health-RI Vanatage6 proposal

1. Menno Sieswerda, Gijs Geleijnse, Erik F will draw up a proposal clinically relevant question (palliative care) and
2. Vantage6 services can be implemented in one day, can docker be replaced by singularity?
3. Go-FAIR certification
4. Possible merge with VODAN: what is needed?

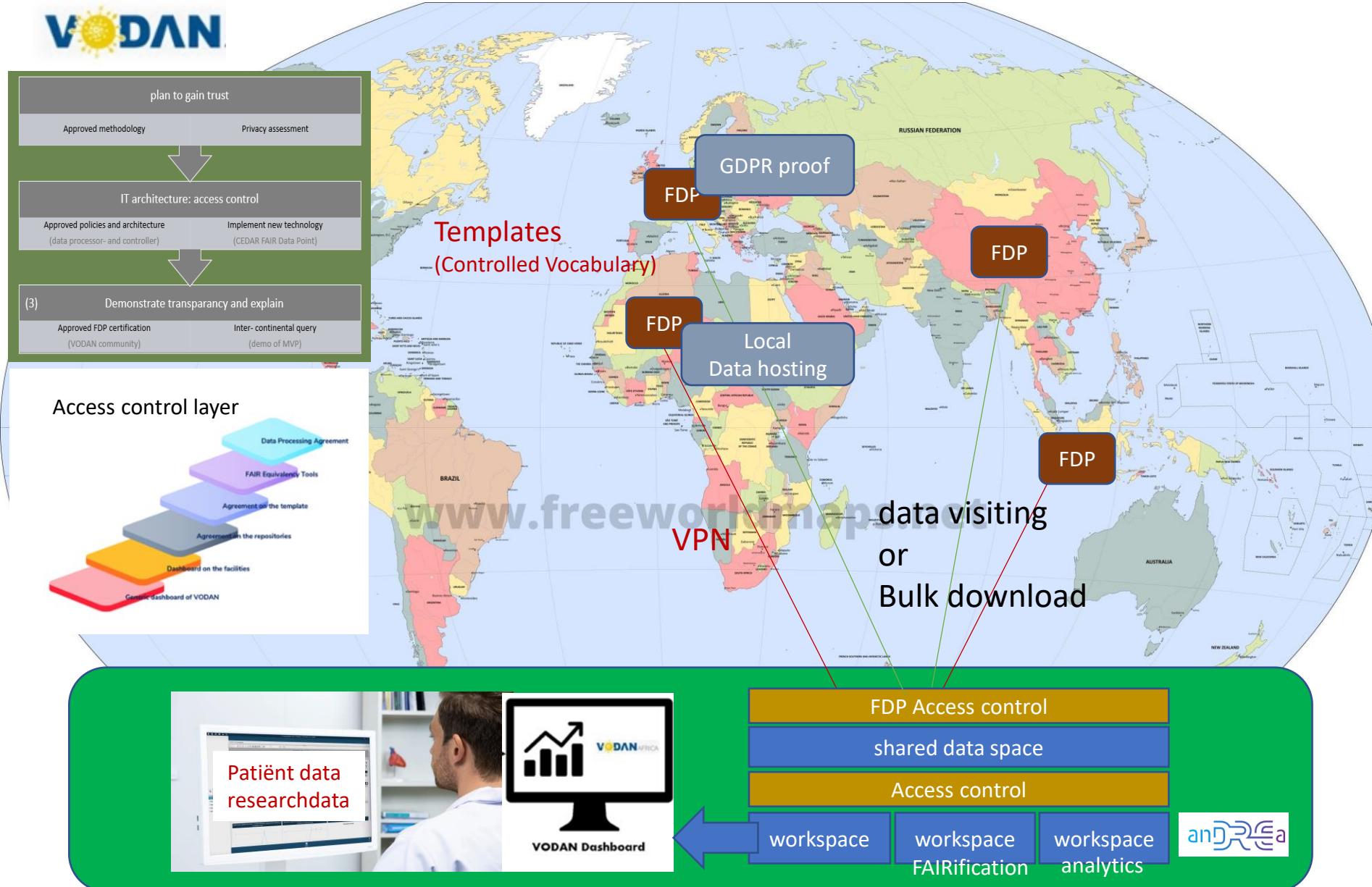
LUMC / VODAN Africa FAIR deployment roadmap: major stepping stone (work in progress)

| Mile-stone | Capability | Outcomes | New to learn | Guidance | methods | Build | Data stewards | links |
|-------------------|--------------|---|---|-------------------------|---------|------------------|---|---|
| 1 | Plan | FAIR project plan | <ul style="list-style-type: none"> • FAIR principles • Data driven / data informed • Culture change • Data Competence Centre | | | | Management advisors | GO FAIR RDA FAIRsFAIR |
| 2a | Create | FAIR data: Catalogue and dataset (open science) | <ul style="list-style-type: none"> • Meta dating according FAIR principles • FAIR community importance | 3 point Fairification | M4M | FIP | Data scientists P.I.'s researchers | 3PFF RDM Starter Kit – GO FAIR (go-fair.org) |
| 2b Q3 2020 | Create | Dataset is findable at FAIR Data Point | <ul style="list-style-type: none"> • Metadating for sys-admins • FAIR IT services | 3 point Fairification | M4M | FDP | Computer scientists Computer experts IT architects | FAIR Data Point VODAN in a Box |
| 3 Q1 2021 | Consume | Data access is Trusted machine actionable | <ul style="list-style-type: none"> • Ethics and local culture agreement • Privacy and GDPR • Security and compliance • Use of data licenses • Risk assessment • IT services | Privacy Care principles | | PHT light | Risk assessment IT Compliance Privacy officer Ethical experts IT architects IT experts | Privacy (access control) framework Domingus/Flikkenschild CARE Principles NIST RDaF FAIR and CARE |
| 4 | Self service | Data access is machine readable (national portal) | <ul style="list-style-type: none"> • PHT concepts • PHT design • PHT deployment • VRE concept (anDREa) | Go-FAIR Health-RI | | PHT COVID portal | | Personal Health Train |
| 5 | ecosystem | Data visiting on a global scale | <ul style="list-style-type: none"> • Designing a EU open science cloud | | | | Legal / GDPR Ethical | Regulation on European data governance European data strategy European Commission (europa.eu) |

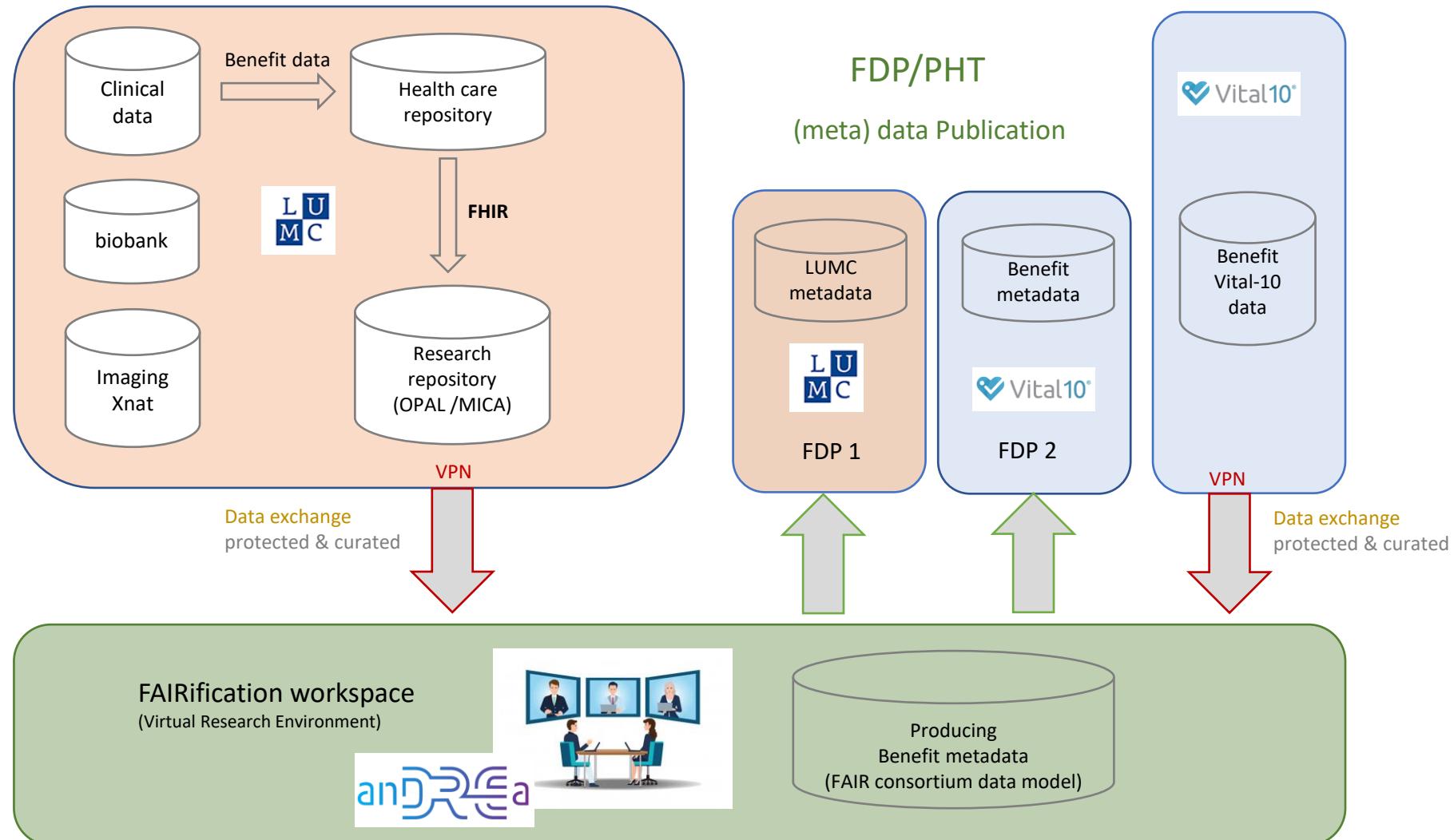
RDaF Structure

| <u>Function</u> | <u>Category</u> | <u>Subcategory</u> |
|-----------------------|---------------------------|--|
| 5) Use / Reuse | <i>Legal and licenses</i> | Ownership, IP, rights and restrictions Agreements, permissions Citation expectations |
| | <i>Data access</i> | Internal, external APIs Downloads vs. visiting |
| | <i>Analysis tools</i> | AI/ML Performance |
| | <i>Impact</i> | Usage tracking, citation |

Community decides on access control policy requirements



Secure environment for producing & publishing FAIR metadata (Benefit program)



Federating learning (FD) = data visiting concept

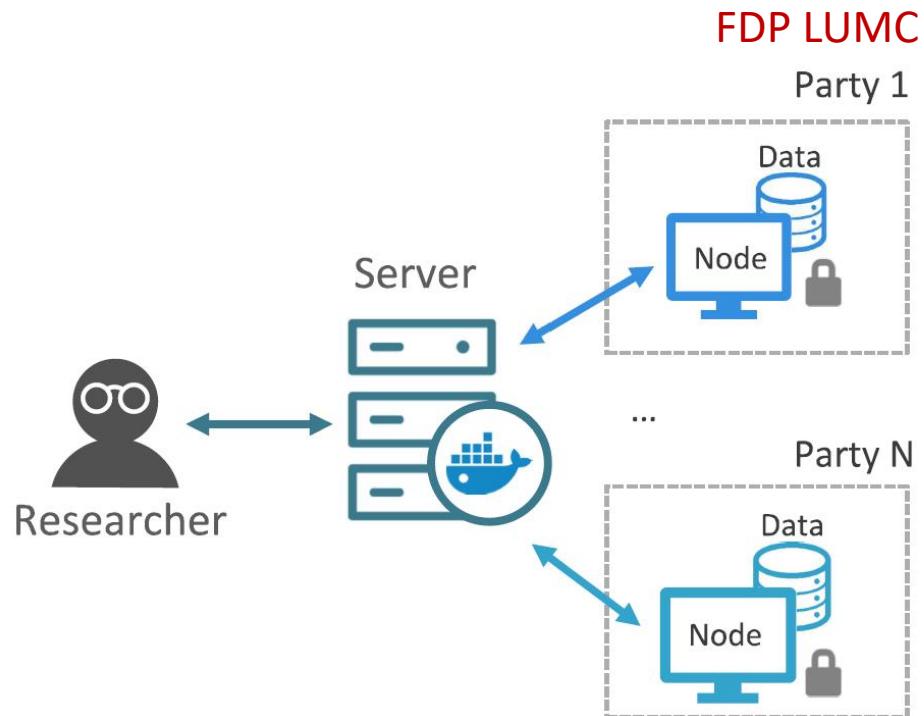


Figure 2: General diagram of the basic components of VANTAGE6. More detailed schematics of the server and nodes are shown in Fig. 3 and 5, respectively

LUMC FDP PHT field lab

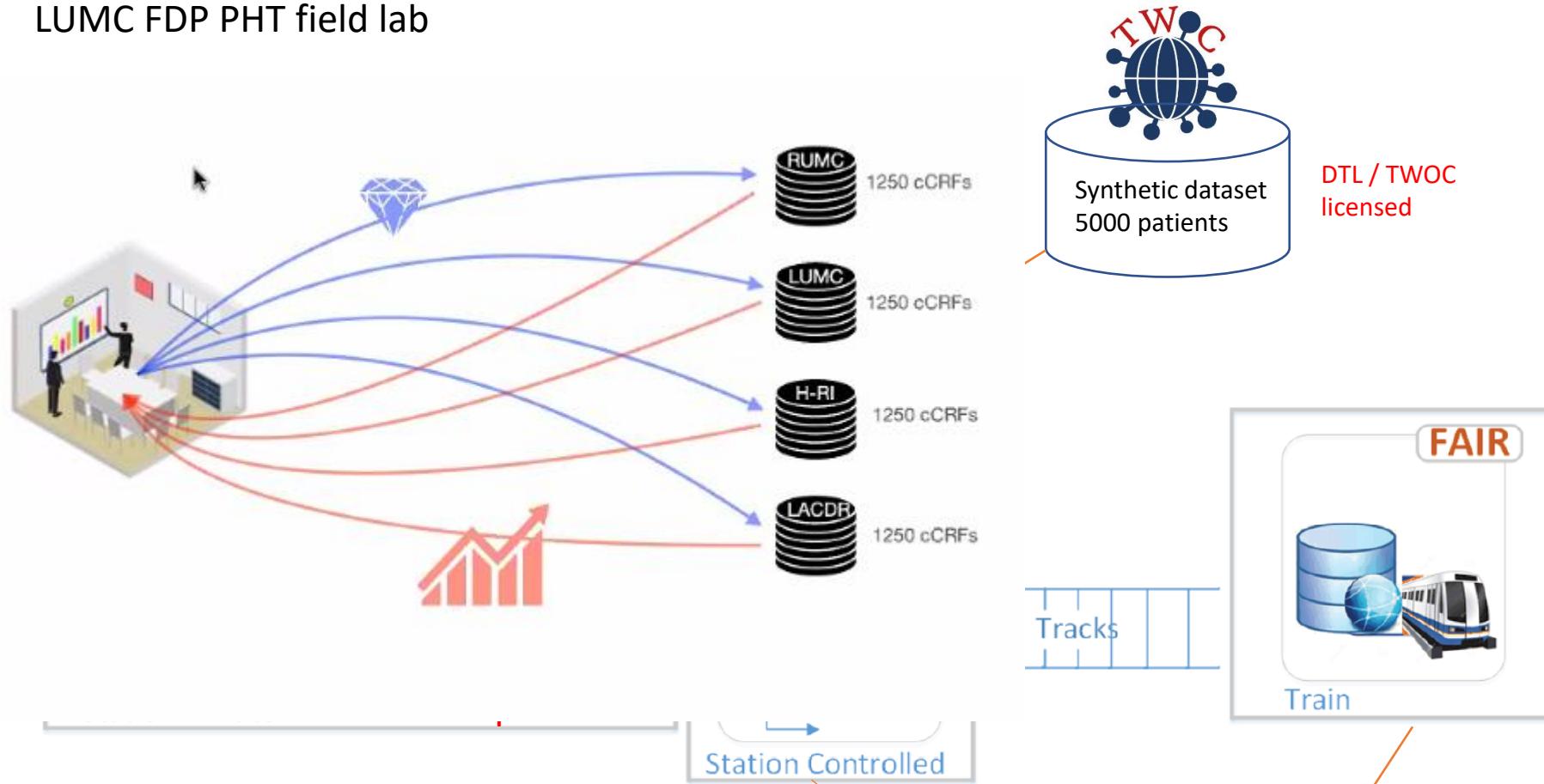


Figure 2. Applicability of FAIR principles to the components of the PHT.

Breng de vraag naar de data (data visiting)
(Go-FAIR VODAN implementation Network)

[AllegroGraph WebView \(lumc.nl\) \(demo\)](#)

Data koppelingen 2.0
FAIR Data Point

 **VODAN** AFRICA & ASIA

HOME ABOUT VODAN ABOUT VODAN AFRICA SPECIAL NEWS VODANA WEBINAR SERIES EVENTS BLOG VODAN-AFRICA IN THE NEWS REPOSITORIES

Home / Special News / Historic First Data Visiting of Patient Data Stored in Residence Across Continents

HISTORIC FIRST DATA VISITING OF PATIENT DATA STORED IN RESIDENCE ACROSS CONTINENTS

By Obinna Osigwe

29 September 2020

2 min read



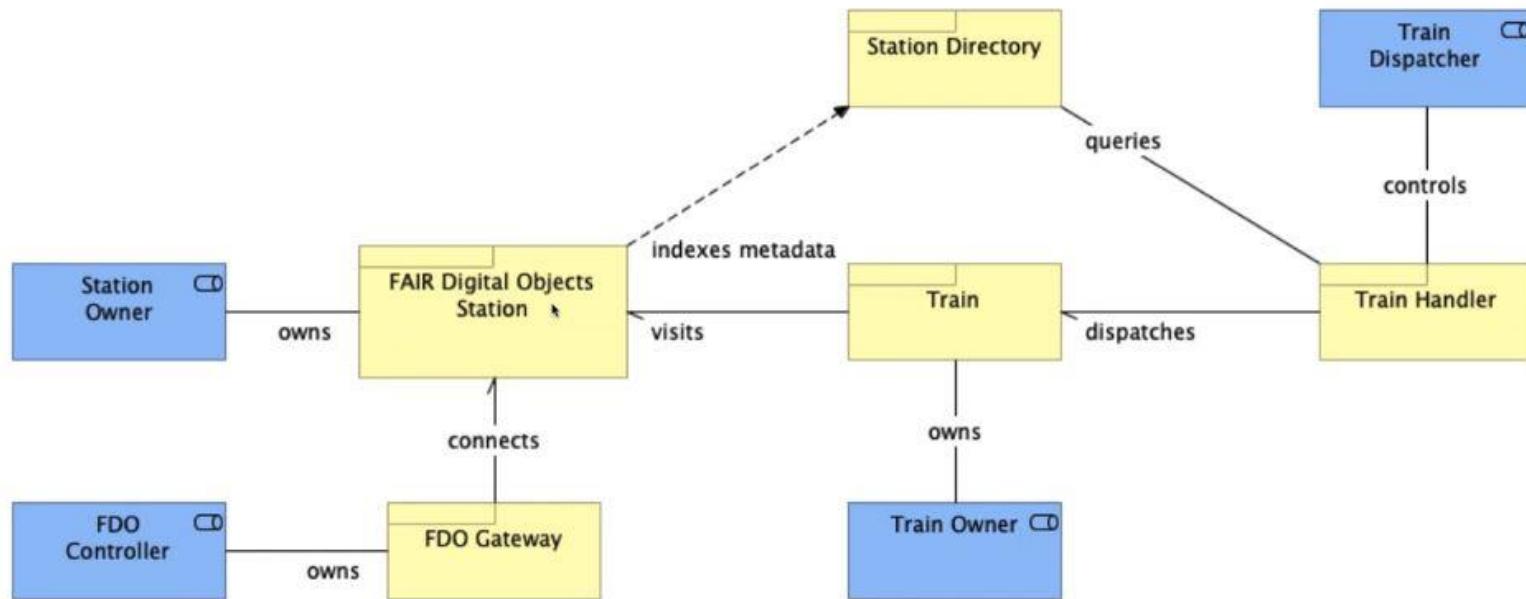
➤ Data: test patiënten
➤ Type koppeling: alle
➤ Method: **data visiting**
➤ Doel: data pooling & linking

Prof. Dr. Mirjam van Reisen – Global Coordinator VODAN Africa.

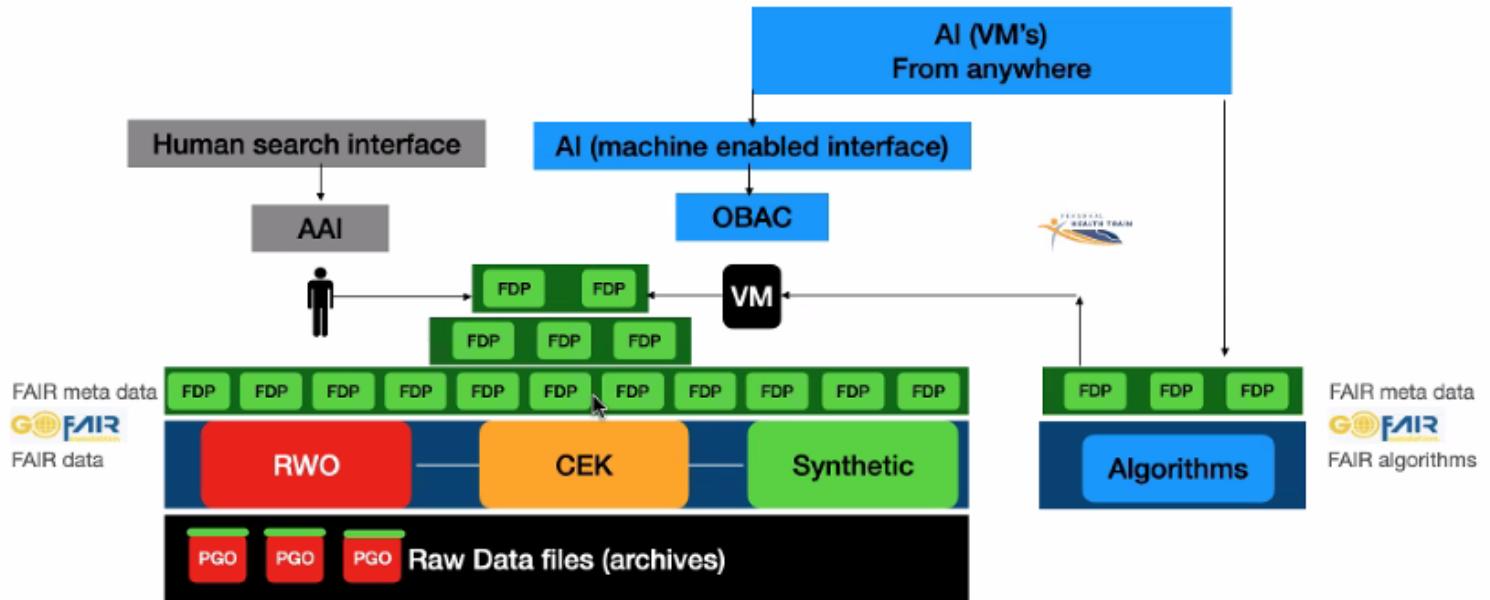
Prof. Francisca Oladipo – Executive Secretary, VODAN Africa

[Historic First Data Visiting of Patient Data Stored in Residence Across Continents - VODAN-Africa & Asia \(vodan-totafrica.info\)](#)

FDT MAIN COMPONENTS AND ROLES



Connect care and research (work in progress)



RWO Real World Observations

CEK Curated Established Knowledge

Synthetic dataset patients (from scratch build no GDPR restrictions)



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Further reading:
[Design of a FAIR digital data health infrastructure in Africa for COVID-19 reporting and research - Reisen - 2021 - Advanced Genetics - Wiley Online Library](#)



#52212043

Planning

4 07/10/2021 16:15-18:00 SOLID and Data Standards - A FAIR- based approach to health data - **BENEFIT** - Programme Considering the evolution in Data Curation for Data Science: automated data extraction, **FAIR data management** and semantically integrating biomedical data and enhancing ability to implement a stakeholder's interview in compliance with ethical procedures Mingyue; Katy Wolstencroft and Putu Hadi Purnama Jati

5 14/10/2021 16:15-18:00 Innovation in company settings **The social responsibility of companies and organisations** is considered in light of assessing directions for innovation with a case study of the Philips company in the context of health-services Ronald de Jong, Prof in Practice De Jong, R., Vermeulen, F., The Strategic Transformation of Royal Philips, London Business School. June 2021 Guest lecture and discussion on challenges in company transformation towards Global Development Goals - during this lecture we will also introduce the concept of 'stakeholders' and introduce 'FieldLab mentors'. We will present the next assignment on exploring expectations of Fieldlab mentors and other stakeholders. We will discuss how to practically prepare for interviews and what tools to use (consent, interview topic list, ethical considerations).

28/10/2021 16:15-18:00 **The Virus Outbreak Data Network (VODAN)**-Africa Students will be informed about the challenges of an innovation and what may contribute to the success of the innovation, including SMART goals Francisca Oladipo and Aliya Aktau SMART-planning tools F

8 04/11/2021 16:15-18:00 Skills development 1: Interoperability through **FAIR-Template creation in CEDAR**, SparQL, deidentification and unique identifiers
Mariam Basajja, Aliya Aktau, Yi Lin, Ruduan Plug

9 11/11/2021 16:15-18:00 Skills development 2: **Interoperability through FAIR-Template creation in CEDAR**, SparQL, deidentification and unique identifiers
Students will acquire the competences Mariam Basajja, Aliya Aktau, Yi Lin, Ruduan Plug provided by trainers

10 18/11/2021 16:15-18:00 **Personal Health Train LUMC**, accessibility, permissions and interoperability issues Reflecting on accessibility and security issues based on a case study of FAIR-Innovation in Leiden University Medical Centre to generate ideas on possible solutions for Fieldlab problems Guest lecture by Erik Flikkenschild Purnama Jati, P.H., Lin, Y., Cohyono, D. B., Nodehi, S., & van Reisen, M. (2021). FAIR and Open Data differences. Data Intelligence. Special Issue. Forthcoming. and Purnama Jati, P.H., van Reisen, M., Flikkenschild, E., Oladipo, F. O., Meerman, B., Plug, R., & Nodehi, S. (2021). Data Access, Control, and Privacy Protection on VODAN Africa Architecture. Data Intelligence. Special Issue. Forthcoming. Discussion on permission and access challenges competence

Hey, let me introduce myself as the one responsible for the course! Prof Dr Mirjam van Reisen <https://www.universiteitleiden.nl/en/staffmembers/mirjam-van-reisen#tab-1>
<https://www.lumc.nl/org/lu-cid/medewerkers/mirjamvanreisen> Prof. Dr. Mirjam van Reisen hold the chair FAIR Data Science at the Leiden University Medical Centre. She previously held the chair Computing for Society at the Leiden Institute for Advanced Computer Science. Mirjam van Reisen is also Prof International Relations, Innovation and Care at Tilburg University Faculty of Humanities and Digital Sciences, Department of Culture Studies. from 2012 - 2021 Van Reisen was a member of the Dutch Government Advisory Council on International Relations and Chair of the Committee on Development Cooperation. She chairs various research programs, among others the advisory committees of the Scientific Centre of the Dutch Ministry of Justice. Van Reisen is the International Coordinator of the Virus Outbreak Data Network (VODAN) - Africa and Asia. She is project leader of numerous programs funded by NUFFIC, the European Union, NWO and ZonMW funders. She is coordinator of the international research network Globalization, Accessibility, Innovation and Care (GAIC). She teaches Data Science Field Labs, Regulatory Governance for Data Science and Globalization and Migration. Van Reisen is Founding Director of the Europe External Policy Advisors based on Brussels. She was also a founding board member of the Philips Foundation. She received the Golden Image Award from President Ellen Johnson-Sirleaf of Liberia.

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Lecturers

Prof. Dr. Mark Musen (Stanford)

Prof. Ronald de Jong (Tilburg)

Prof. Dr. Francisca Onaolapo Oladipo Federal University Lokoja (FUL), Nigeria.

Dr. Katy Wolstencroft e leads the Semantic Systems Bioinformatics group at the Leiden Institute of Advanced Computer Science (LIACS)

Aliya Aktau PhD kandidate at Leiden University

Putu Hadi Purnama Jati master graduate from the Leiden Institute of Advanced Computer Science (LIACS)

Erik Flikkenschild Senior IT advisor Research (LUMC)

Guest lectures:

- Mustafa Kedioglu: Project management
- Prof Mark Musen: Bio-informatics and the CEDAR Platform
- Prof Ronald de Jong: Steering projects in practice
- Prof Francisca Oladipo: The Virus Outbreak Data Network programme
- Ruduan Plug: statistical AI of federated data
- Mariam Basajja and Aliya Aktau: creating machine-readable ontologies and SparQL queries with deidentified data and unique identifiers
- Putu Hadi Purnama Jati: Access and control and permission under GDPR
- Dr Katy Wolstencroft: Data management solutions
- Yi Lin: Data visualization and analytics
- Erik Flikkenschild: FAIR implementation, Personal Health Train and data security

