

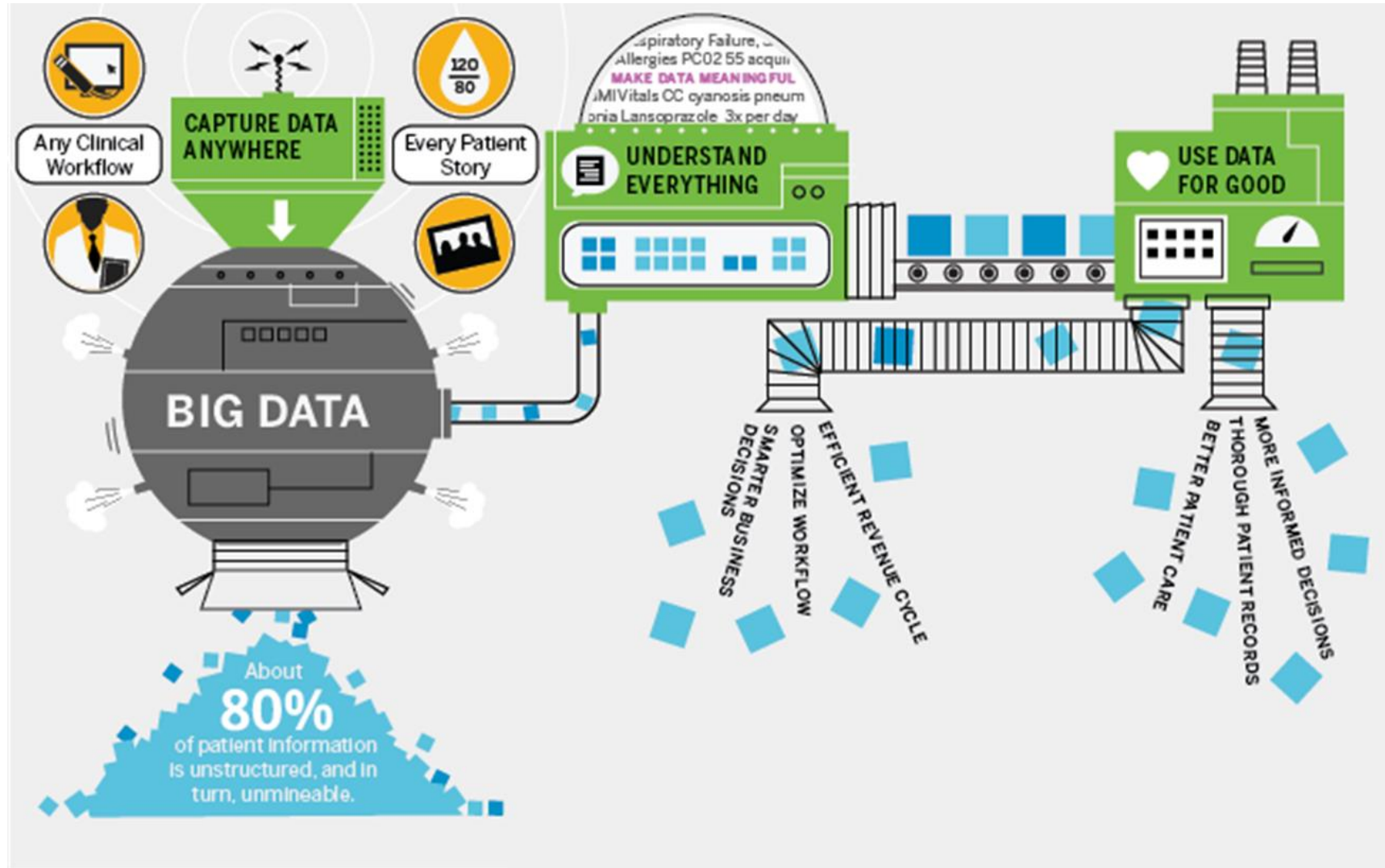
Personal Health Train

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Department of Radiation Oncology (MAASTRO clinic)

Maastricht University, The Netherlands

Capture, Understand, Use



nuance.com

Barriers to sharing data

[..] the problem is not really technical [...]. Rather, the problems are **ethical, political, and administrative.**

Lancet Oncol 2011;12:933

1. Administrative (I don't have the resources)
2. Political (I don't want to)
3. Ethical (I am not allowed to)
4. Technical (I can't)



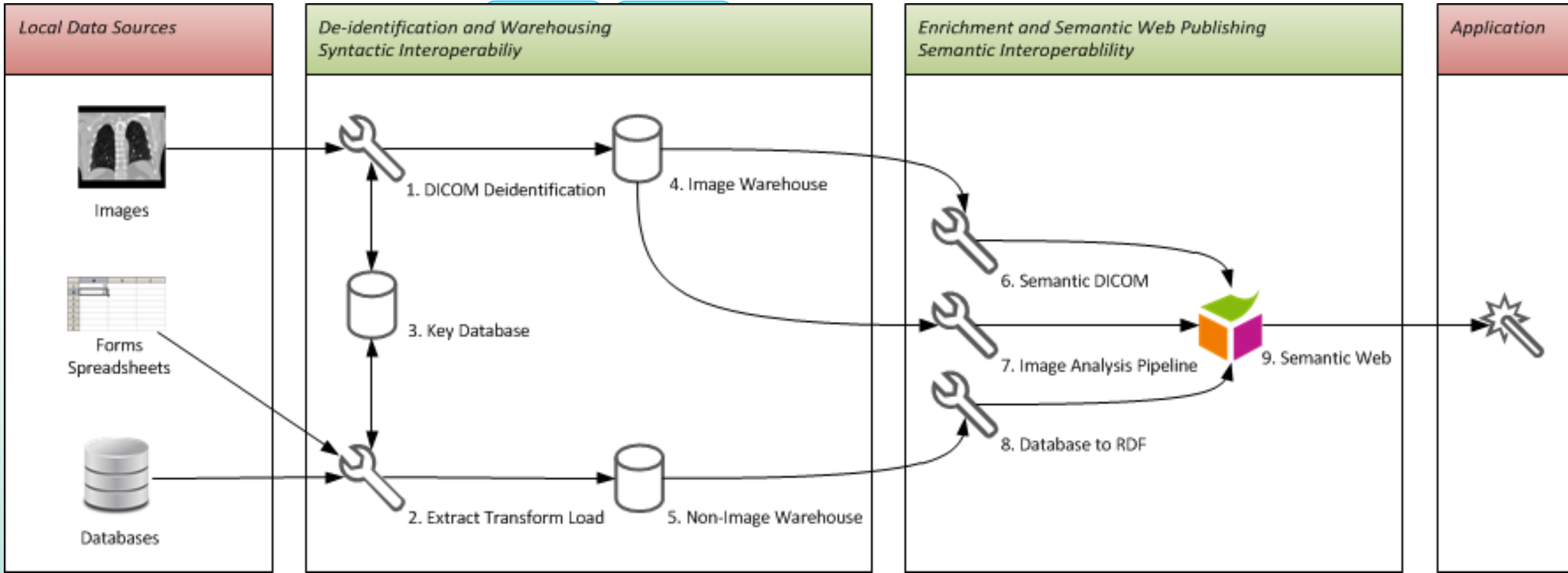
A different approach

- If sharing is the problem: Don't share the data
- If you can't bring the data to the research
- You have to bring the research to the data
- Challenges
 - The research application has to be distributed (trains & track)
 - The data has to be understandable by an application (i.e. not a human) -> FAIR data stations

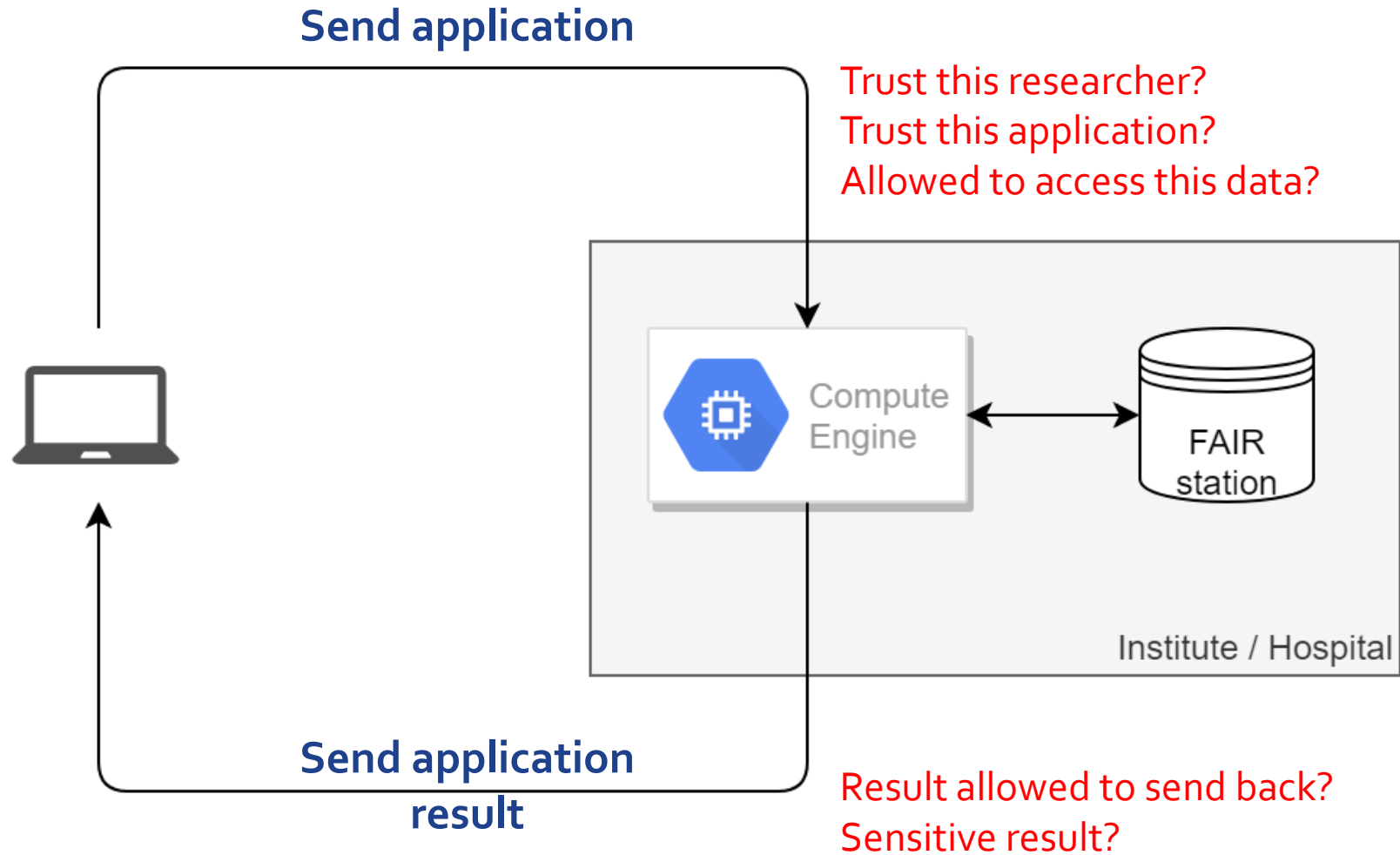


Wilkinson, DOI: [10.1038/sdata.2016.18](https://doi.org/10.1038/sdata.2016.18)

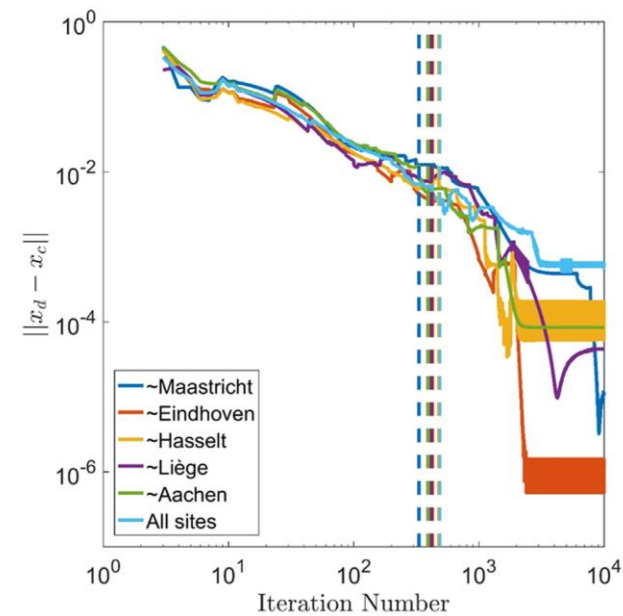
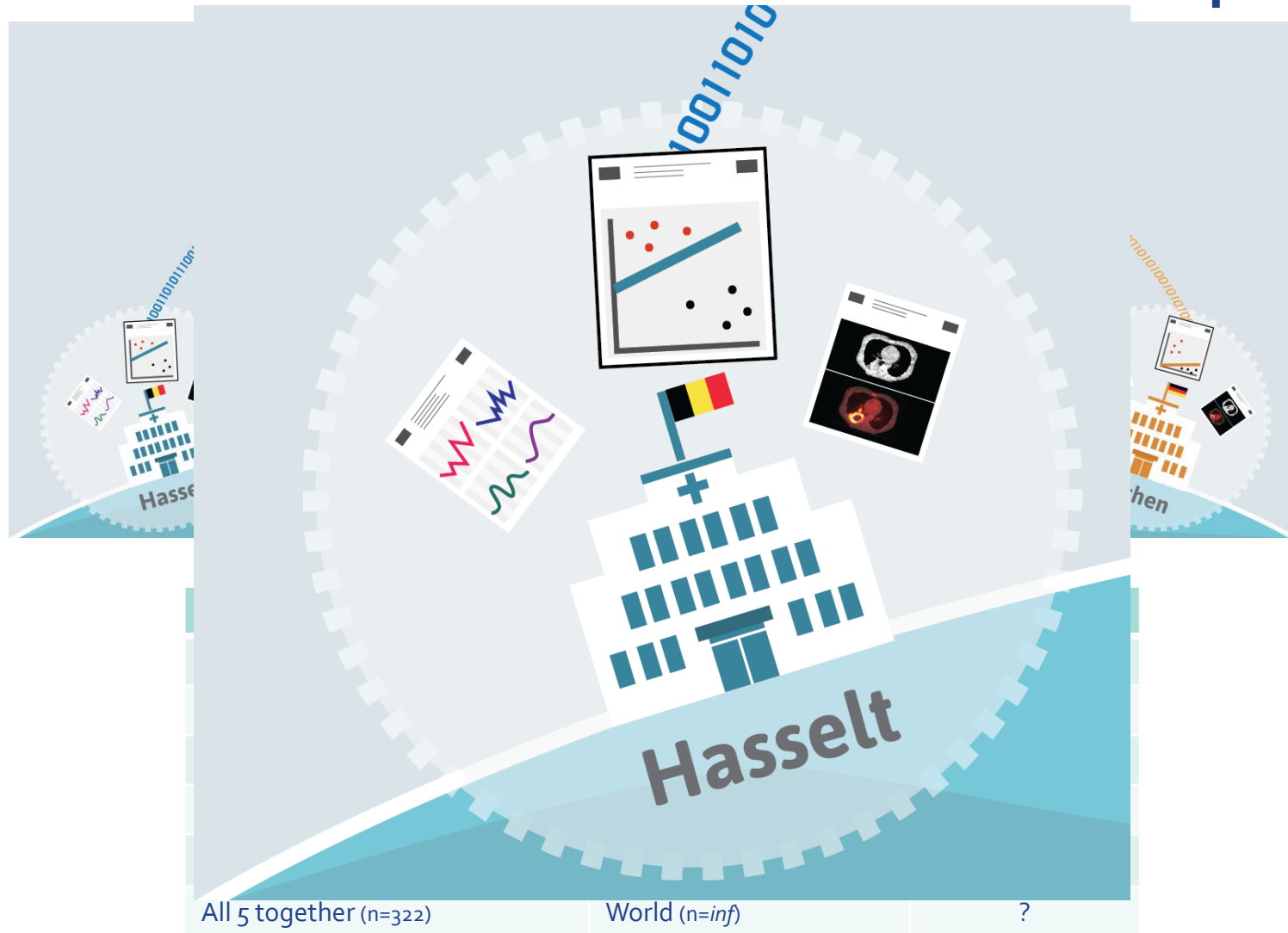
What about the data?



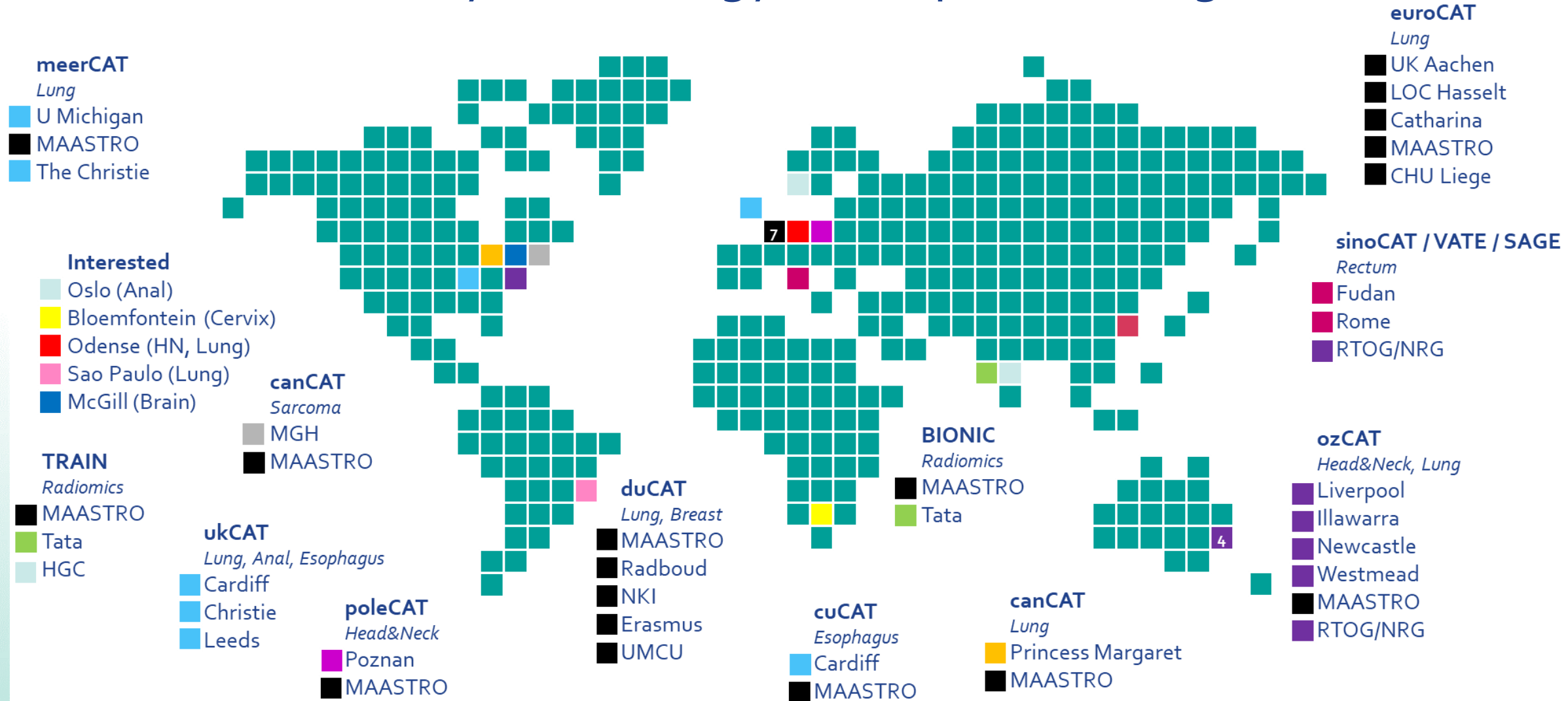
What is actually happening?



Does it work? euroCAT example

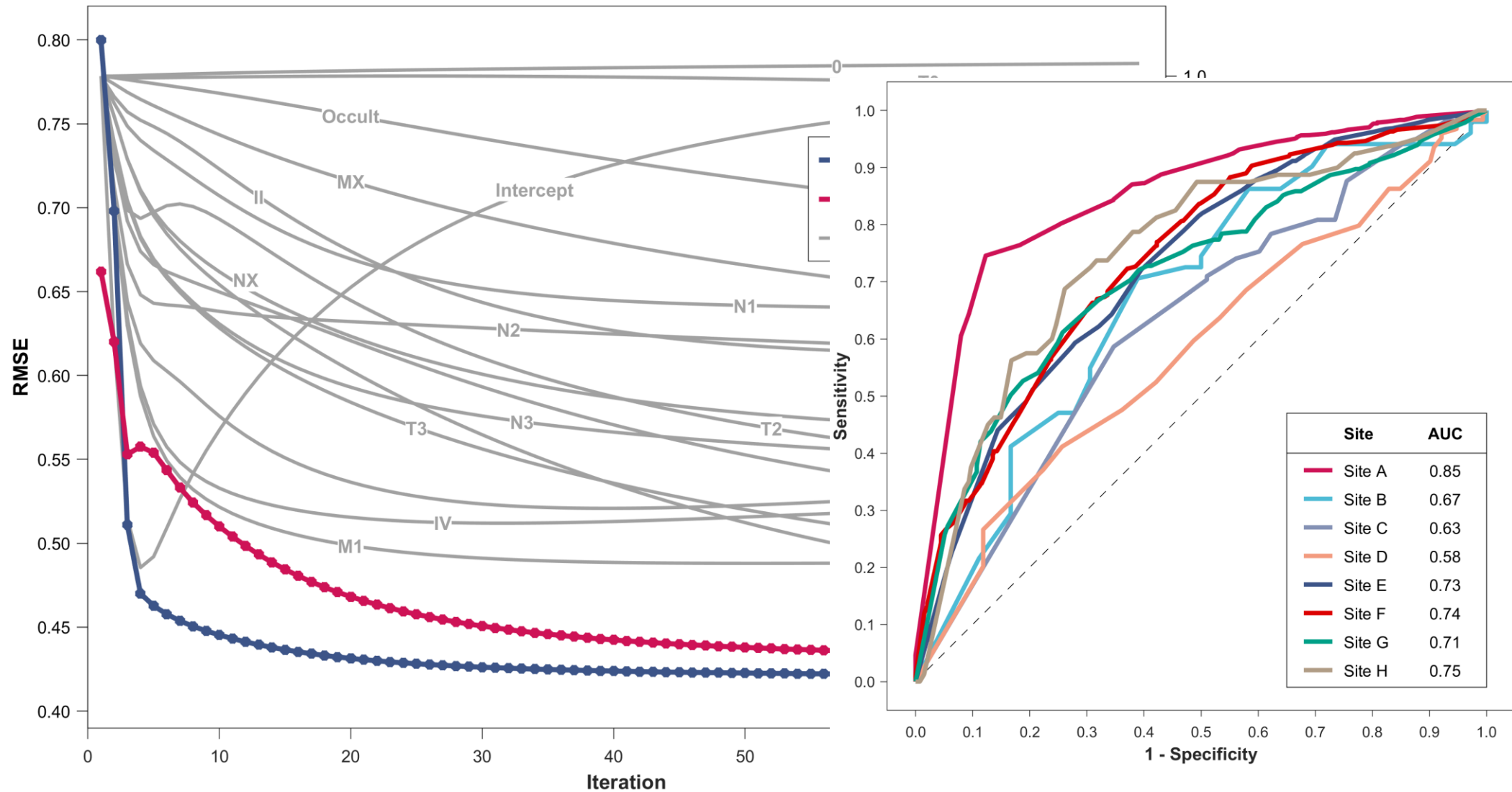


CORAL: Community in Oncology for RApid Learning



Map © Copyright Showeet.com

20k Challenge



Horizontal vs vertical partitioned data

ID	DoB	Gender	HbA1C	Blood glucose
1234
1235
1236

Horizontal
partitioning of data

ID	DoB	Gender	HbA1C	Blood glucose
1234
1235
1236

Deist, Jochems, van Soest et al., Infrastructure and distributed learning methodology for privacy-preserving multi-centric rapid learning health care, ctRO. 4 (2017) 24–31

Horizontal vs vertical partitioned data

ID	DoB	Gender	HbA1C	Blood glucose
1234
1235
1236

Maastricht Study
Population study > 10.000 participants
Interest in Diabetes Mellitus Type 2

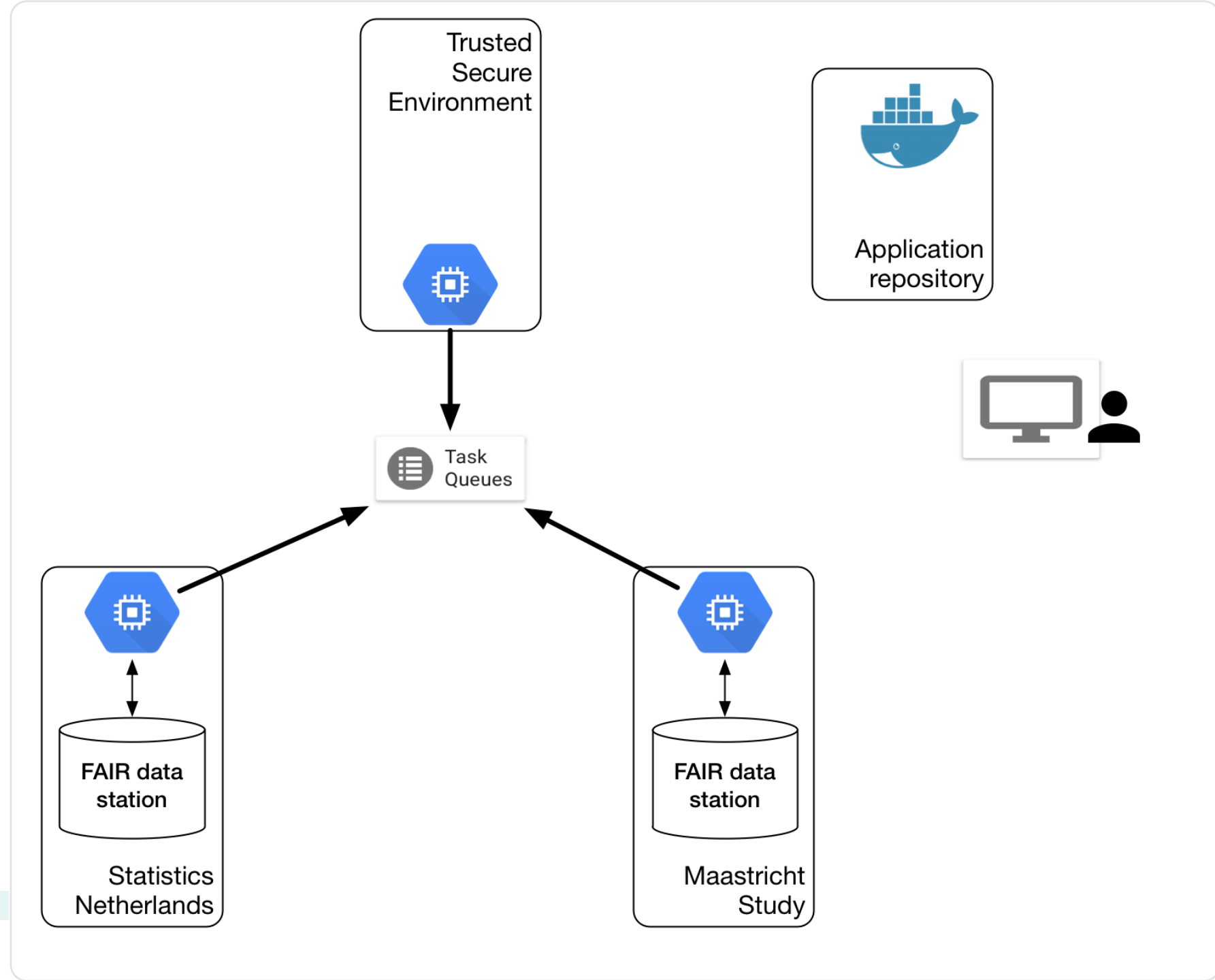
ID	DoB	Income	Hospital visits
1234
1235
1236
1237
1238
1239
1240
1241

Statistics Netherlands
> 16 million citizens

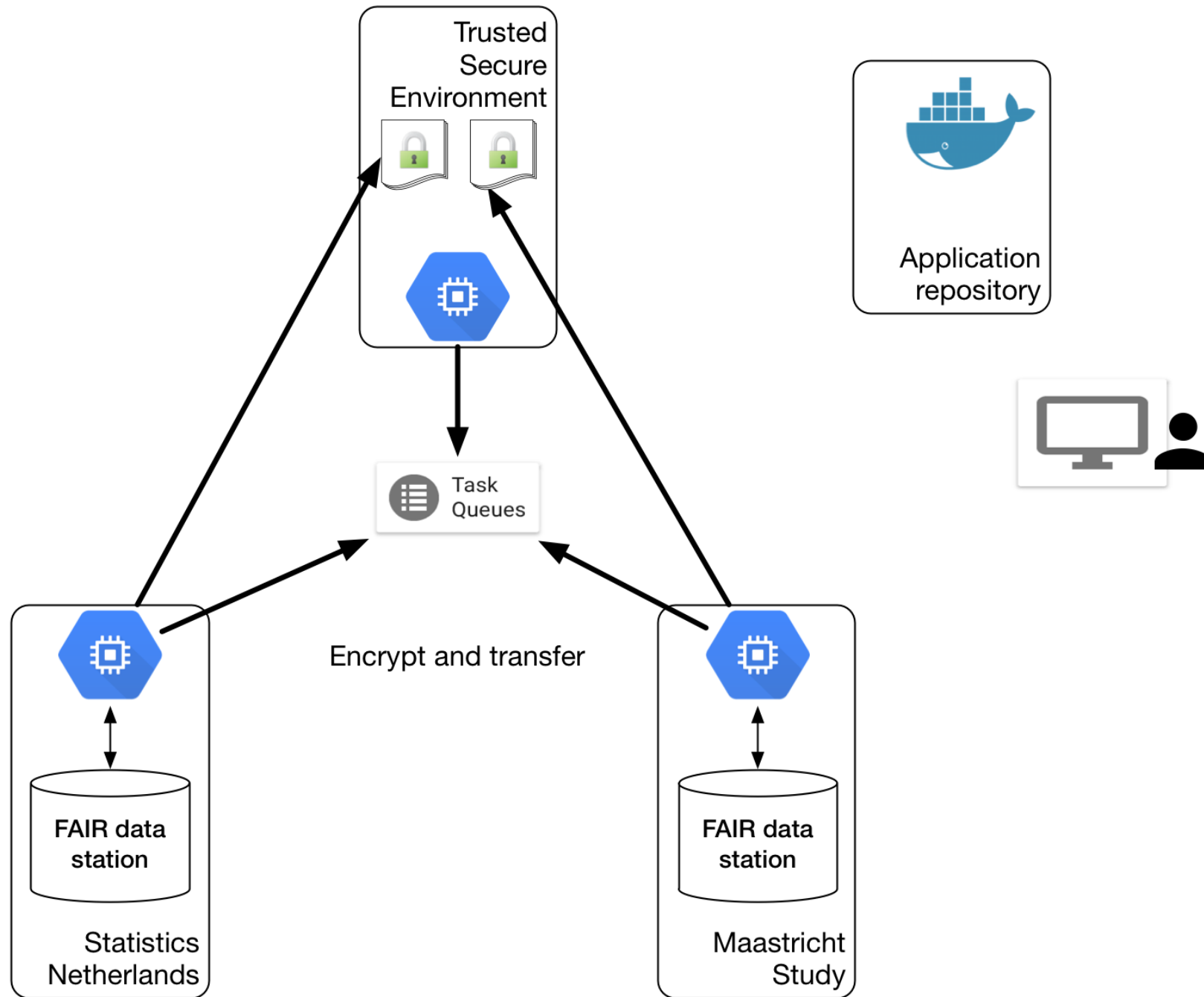
Vertical partitioning of data

Methods

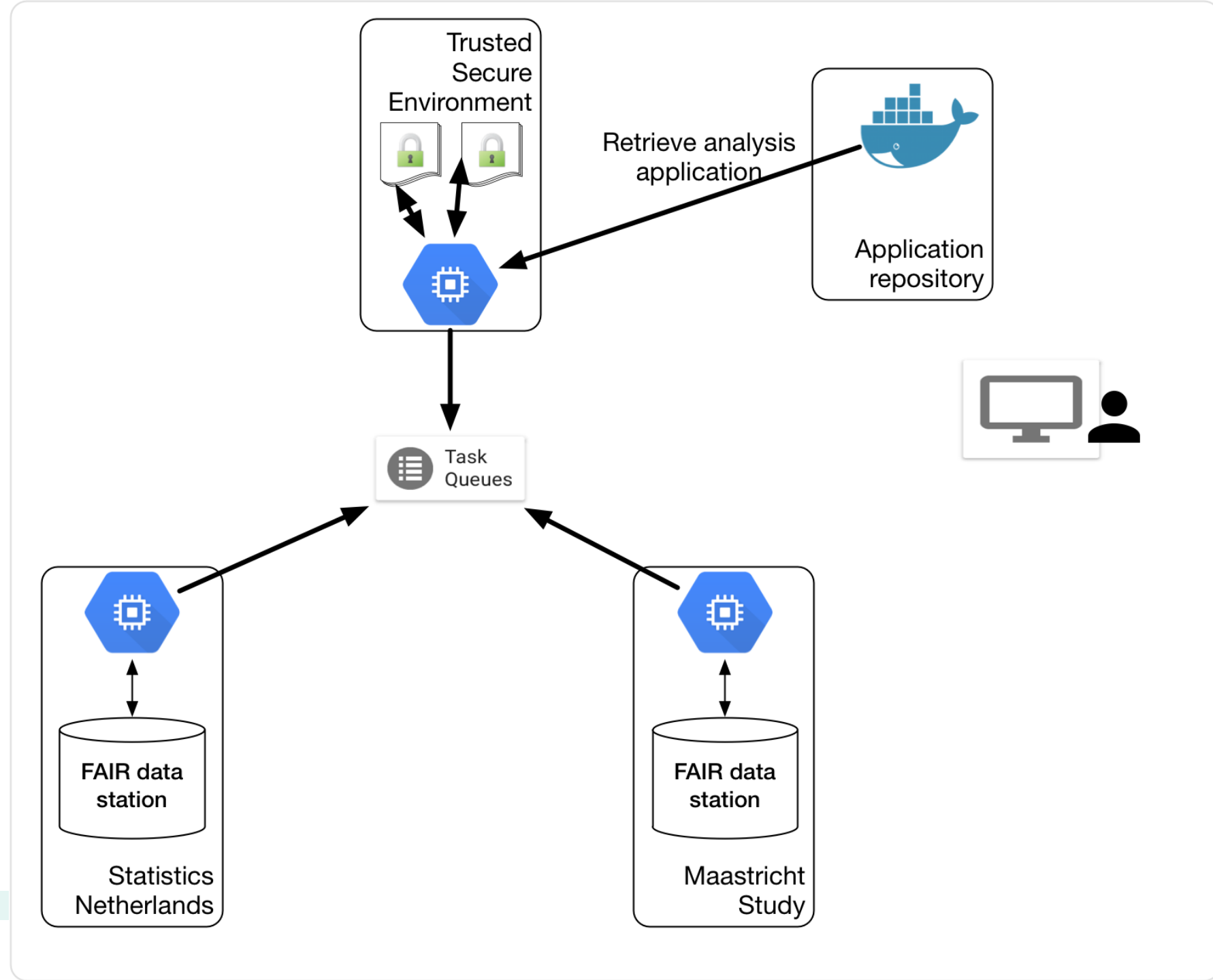
- FAIR data stations
- Infrastructure: Train tracks
- Applications: trains



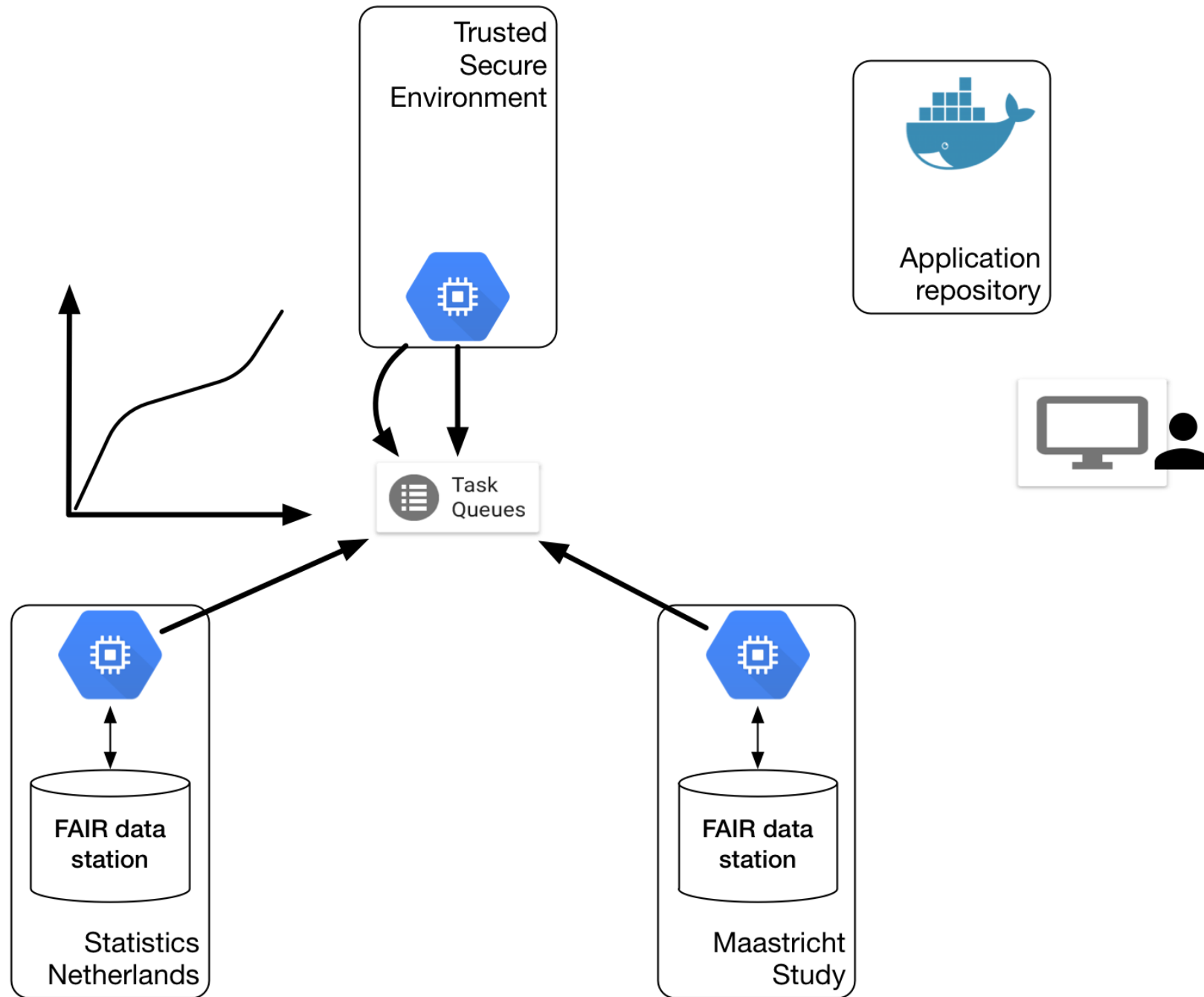
Methods



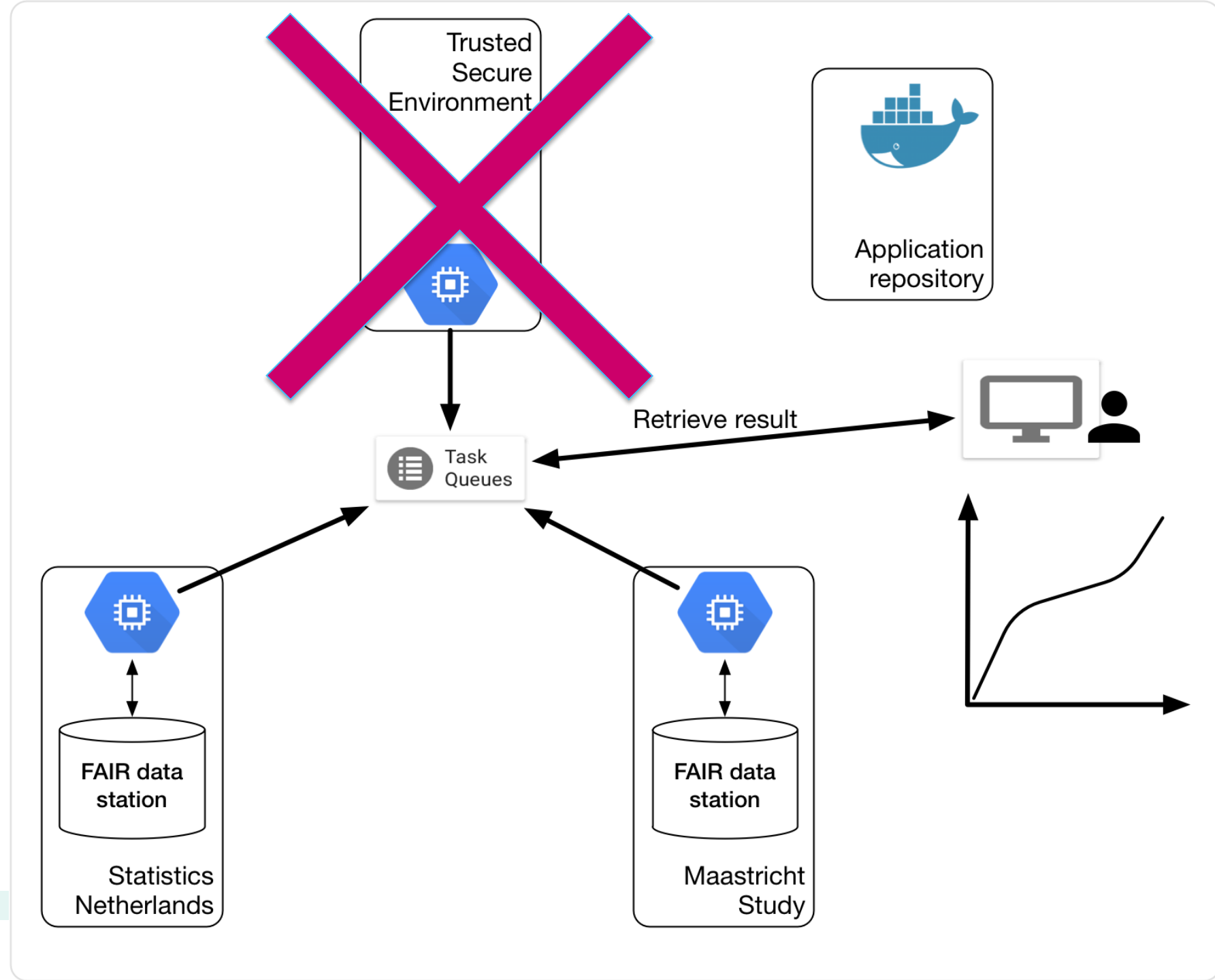
Methods



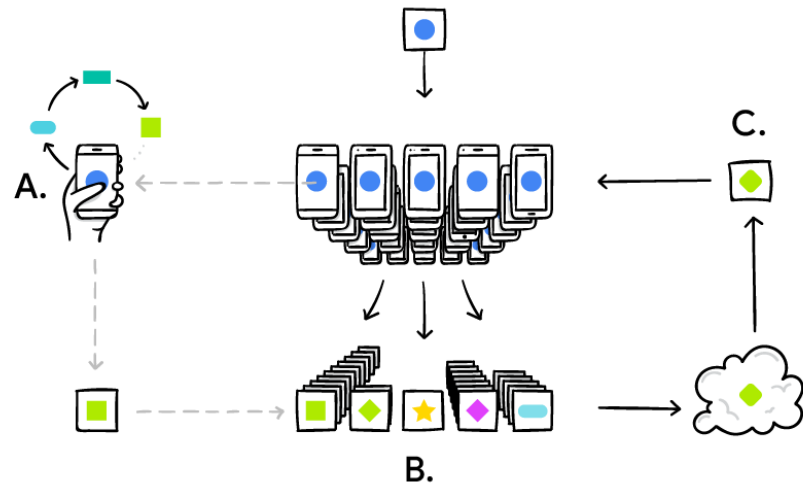
Methods



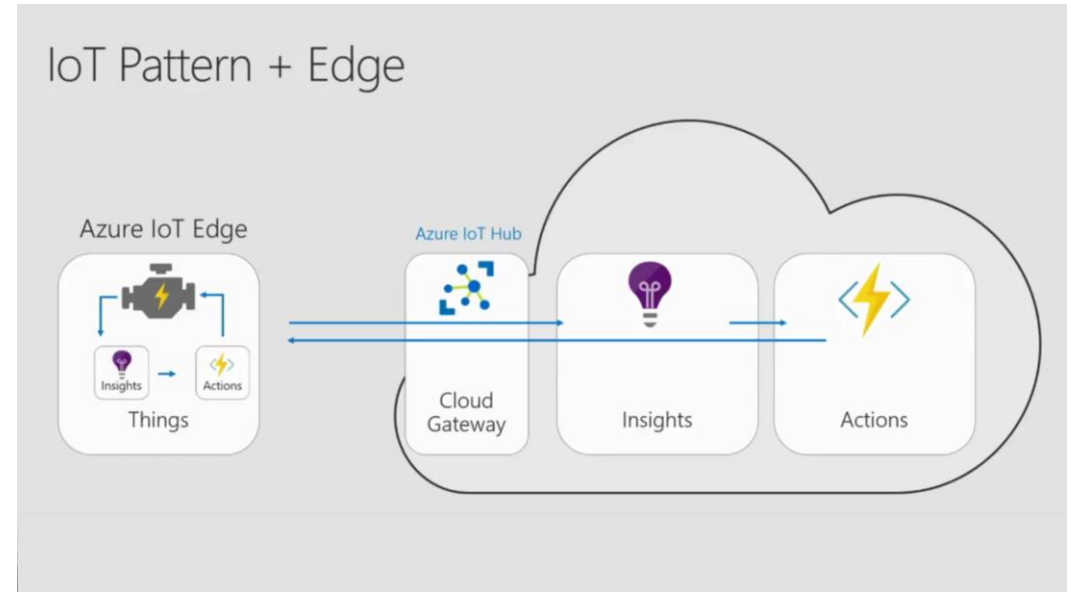
Methods



Is it new?



Your phone personalizes the model locally, based on your usage (A). Many users' updates are aggregated (B) to form a consensus change (C) to the shared model, after which the procedure is repeated. (Google 2017)



Azure IoT Edge moves cloud analytics and business logic to devices



Distributed Analytics Meets Distributed Data with a World Wide Herd



What do we have?

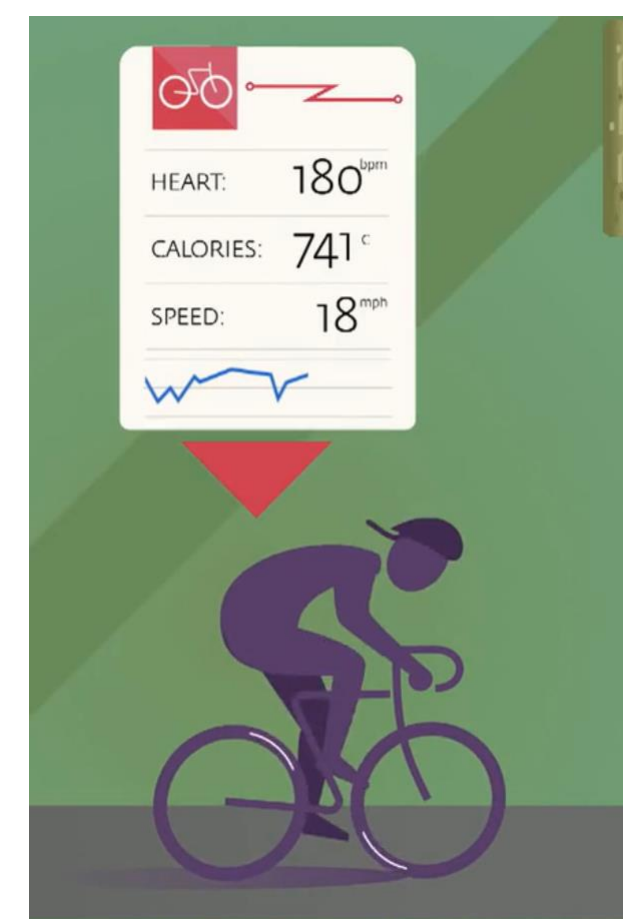
The screenshot displays the Varian Learning Portal interface. A 'Create new run' dialog box is open, showing configuration options for a 'DistributedCox' algorithm. The dialog has tabs for 'Algorithm', 'Patient Variables', 'Tumor Variables', 'Treatment Variables', and 'Outcome variables'. Under 'Patient Variables', 'Sex' is set to 'Male' and 'Age' is set to 50. A slider for 'Age' ranges from 0 to 120. 'Previous' and 'Next' buttons are at the bottom of the dialog.

Below the dialog, a 'Kaplan Meier Outcome' plot is visible. The y-axis is 'Probability' (0.0 to 1.0) and the x-axis is 'Time' (0 to 60). The plot shows a step function starting at 1.0 and decreasing to approximately 0.55 at time 60.

The background interface shows the 'reCAT' algorithm selected, with a list of iterations and a table of results for different sites (Master, Gemelli, Maastrro).

ProPASS – possible use cases

- Exchange information from different platforms / studies / countries collecting wearable data
- Connecting wearable data to other data sources (within a country)
- In line with Personal Health Train initiative www.personalhealthtrain.nl



Thank you / Questions

Netherlands

- MAASTRO, Maastricht, Netherlands
- Radboudumc, Nijmegen, Netherlands
- Erasmus MC, Rotterdam, Netherlands
- Leiden UMC, Leiden, Netherlands
- Catharina Hospital, Eindhoven, Netherlands
- Isala Hospital, Zwolle, Netherlands
- NKI Amsterdam, The Netherlands
- UMCG, Groningen, Netherlands

Europe

- Policlinico Gemelli & UCSC, Roma, Italy
- UH Ghent, Belgium
- UZ Leuven, Belgium
- Cardiff University & Velindre CC, Cardiff, UK
- CHU Liege, Belgium
- Uniklinikum Aachen, Germany
- LOC Genk/Hasselt, Belgium
- The Christie, Manchester, UK
- State Hospital, Rovigo, Italy
- St James Institute of Oncology, Leeds, UK
- U of Southern Denmark, Odense, Denmark
- Greater Poland Cancer Center, Poznan, Poland
- Oslo University Hospital, Oslo, Norway

Africa

- University of the Free State, Bloemfontein, South Africa

Asia

- Fudan Cancer Center, Shanghai, China
- CDAC, Pune, India
- Tata Memorial, Mumbai, India
- Suining Central Hospital, Suining, China
- HGC Oncology, Bangalore, India

North America

- RTOG, Philadelphia, PA, USA
- MGH, Boston, MA, USA
- University of Michigan, Ann Arbor, USA
- Princess Margaret CC, Canada

South America

- Albert Einstein, Sao Paulo, Brazil

Australia

- University of Sydney, Australia
- Westmead Hospital, Sydney, Australia
- Liverpool and Macarthur CC, Australia
- ICC, Wollongong Australia
- Calvary Mater, Newcastle, Australia
- North Coast Cancer Institute, Coffs Harbour, Australia

Industry

- Varian, Palo Alto, CA, USA
- Philips, Bangalore, India
- Sohard GmbH, Fuerth, Germany
- Microsoft, Hyderabad, India
- Mirada Medical, Oxford, UK
- CZ Health Insurance, Tilburg, NL
- Siemens, Malvern, PA, USA
- Roche, Woerden, NL
- Medical Data Works, Heerlen, NL

