Using real-world patient data to enable proactive surgical care

the challenges of an AI startup company in health tech.

health .plus.ai

Outline

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3. Our approach to solve the problem
4. Challenges
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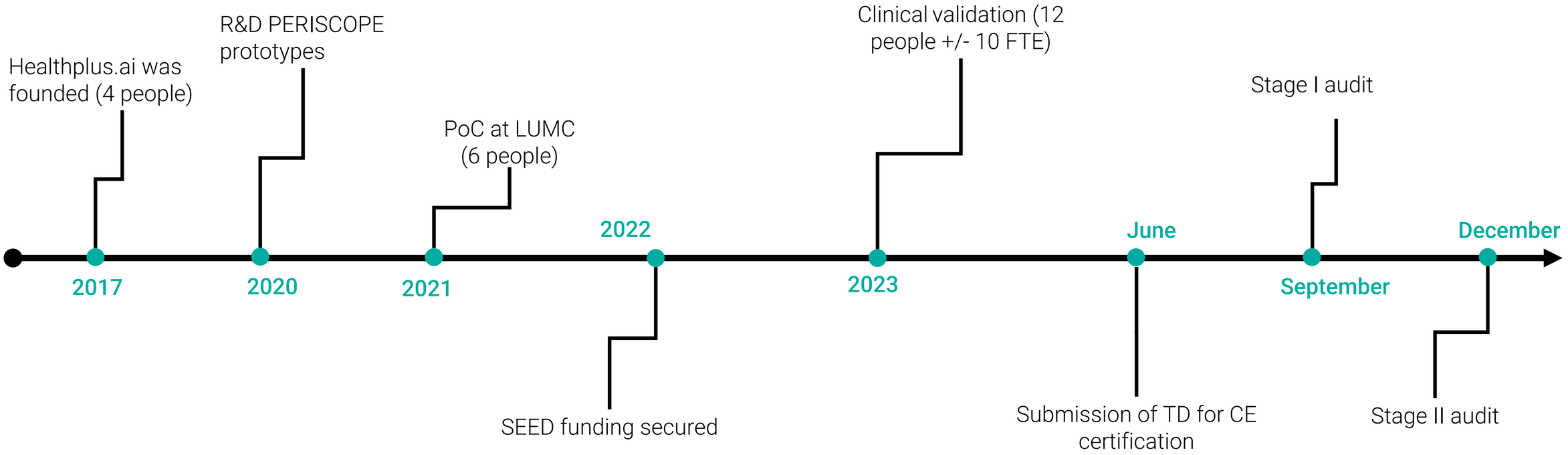
About Healthplus.ai



The problem we aim to solve…

Depending on the clinic, 17-25% of surgery patients get an infection.

Infections are detected late (avg 5 days) leading to invasive and expensive treatments (doubling stay and recovery times).

…and its context.

Data availability is high

actual use of data is very low

Shortage of qualified health workers

and even more so in the future

Expenses of the healthcare system increase

becoming unsustainable in the future

Our approach to solve the problem

periscope™
infection intelligence

Meet PERISCOPE

PERISCOPE is an artificial intelligence (AI) -based, standalone clinical decision support software which predicts the probability of an individual patient requiring (a) clinical action related to the diagnosis and/or treatment of a postoperative bacterial infection following a surgical procedure in the hospital setting. The aim is to reduce the severity and impact of infection by supporting decision-making.

PERISCOPE offers two simultaneous predictions after surgery: a short-term prediction (valid up to and including postoperative day 7) and a medium-term prediction (valid up to and including postoperative day 30). The software processes the patient's electronic health data and presents the predictions after the end of the surgery.

Predicting infections

immediately after surgery

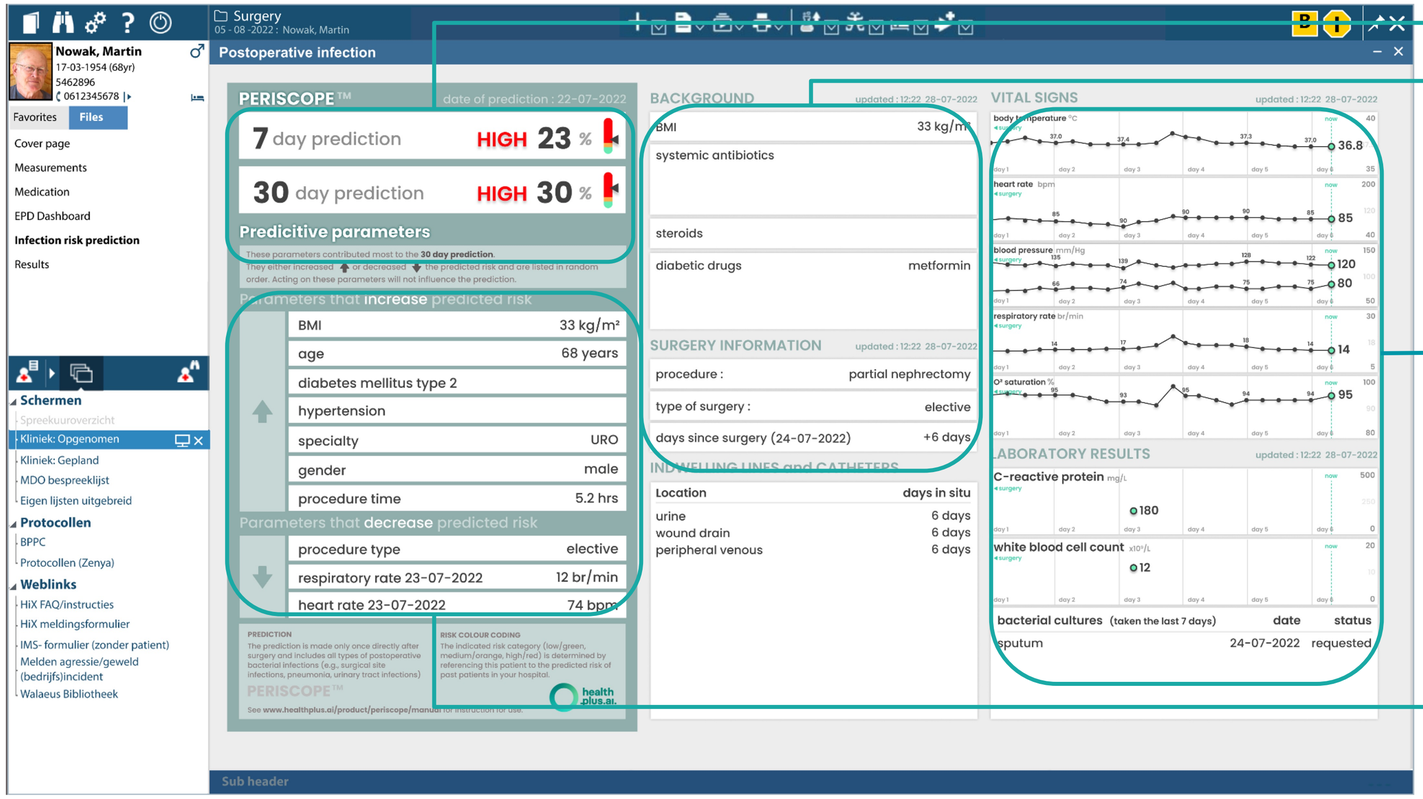
Consolidate data

and turn it into focussed infection related information

Integrate in workflow

make an appearance at the center of the information system, the EHR

What it looks like for the clinician and nurse



Predictions
7 & 30-day & traffic light

Background
Relevant surgery and patient data

Trend display
Continuously updated
Relevant laboratory and vital signs information

Explainability
Risk factors that increase & decrease the risk of an infection

Challenges we face

Getting the data

Noticed the huge gap in the timeline between 2017 and 2020? As trivial as it seems, getting the health records needed to develop our model took at least 2 years and multiple research projects.

When the formalities are finalized the actual technical challenge starts. Most hospitals do not allow data to go off premise. Different solutions such as VM's that can be accessed over a VPN or via a web-interface are currently in place.

In this is just for the development part. In production things get slightly more complex as we need data every 5 minutes and have to feed the results back into the EHR.

Getting the data

each hospital uses a different process and means

Data is not standardized

although good efforts have been made

Huge barriers to entry

due to regulatory requirements

Challenges we face

Non-standardized data

Most hospitals have an EHR system. In the Netherlands most hospitals even have the same EHR system. Database structures mostly follow the same design, content does not.

Coding systems can be different between hospitals. Often multiple codes exist for the same thing and multiple coding standards can be in use for different applications (SNOMED CT, VT, NZa).

e.g.:

1. Procedure codes get assigned, the made obsolete and later re-assigned again to different procedures
2. Conditions could follow ICD, but are often expanded with hospital specific codes and even specialty specific codes

Translating the hospital specific data, both structural and content wise, to what PERISCOPE needs takes serious effort from data engineers and medical specialists.

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Challenges we face

Barriers to entry

PERISCOPE is subject to the Medical Device Regulation (EU 2017/745) which means that as a manufacturer (that is us) you need to:

- develop the software according to ISO 62304
- set up a Quality Management System (ISO 13485)
- perform a risk assessment of the device (ISO 14971)
- perform a clinical evaluation

And get certified for all these standards (and some more) before you can sell a single product.

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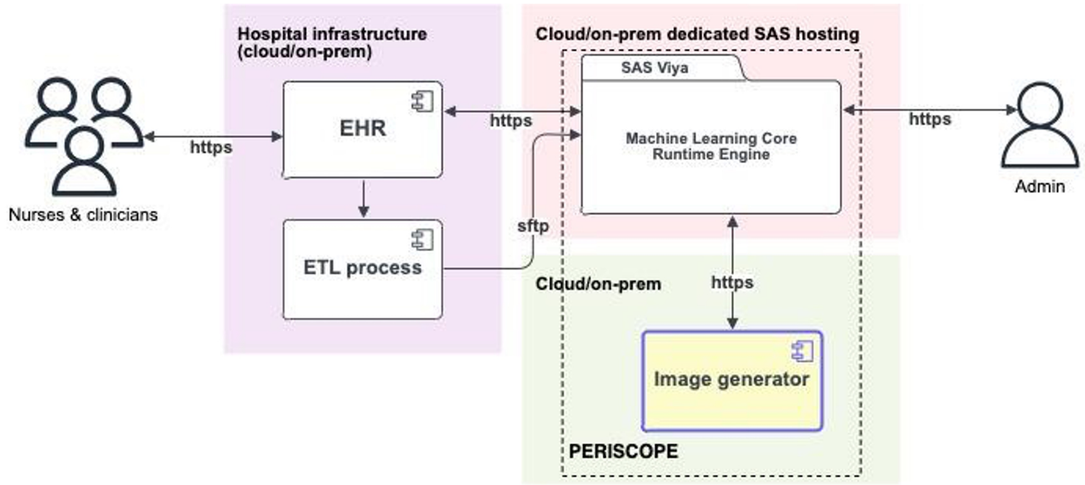
High Level Architecture



Separation of ETL

We developed an internal standard (data interface) based on FHIR that is fed into PERISCOPE by an ETL process. This process is hospital specific and can be executed by the hospital, us or a 3rd party such as an EHR vendor. Mapping is performed in this step.

Separation of machine learning, operations and UI

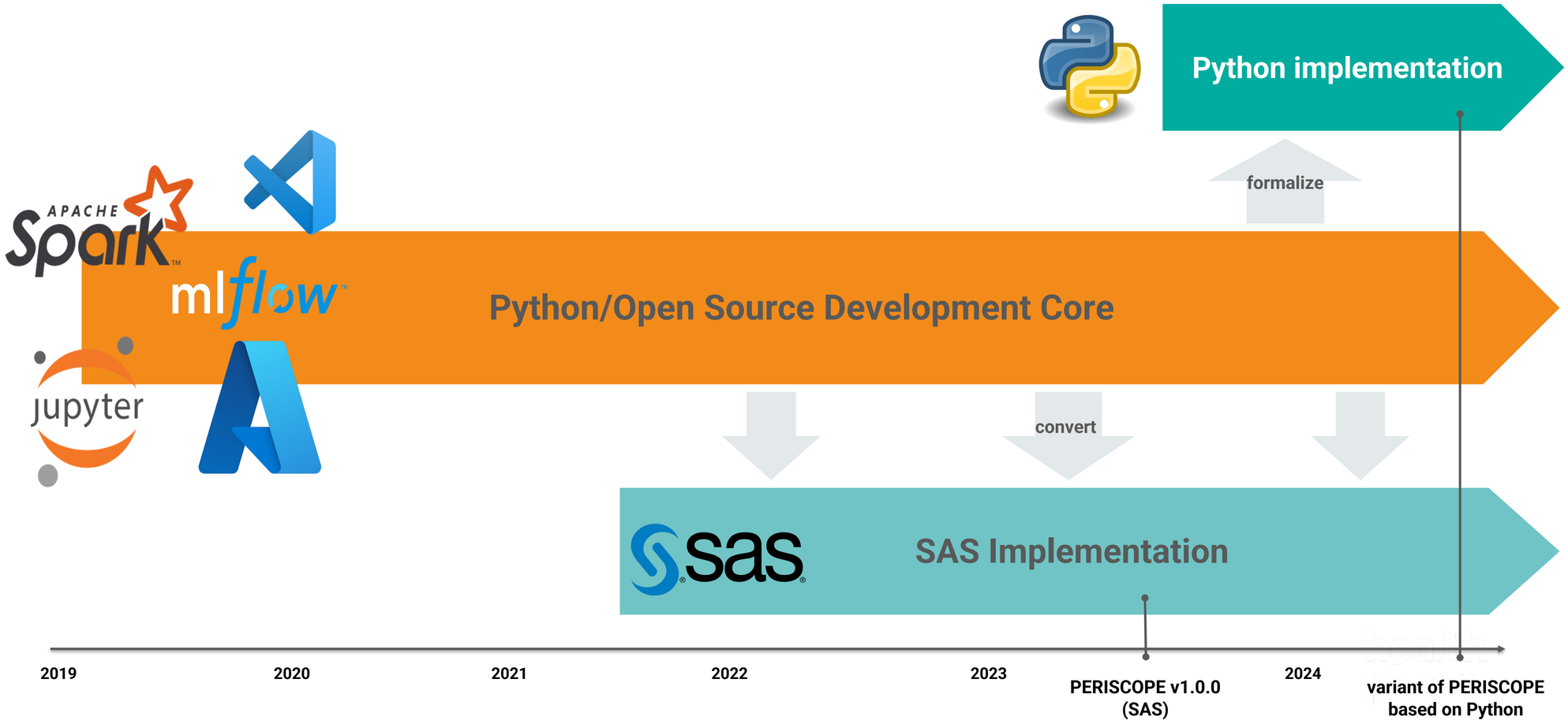
Data processing is kept separate from UI generation and generic operational functionality such as process monitoring, alerting, scheduling etc. The UI is precompiled to address any portability issues.

REST API to share results

A REST API is exposed to share the precompiled interface with an EHR system or other hospital systems.

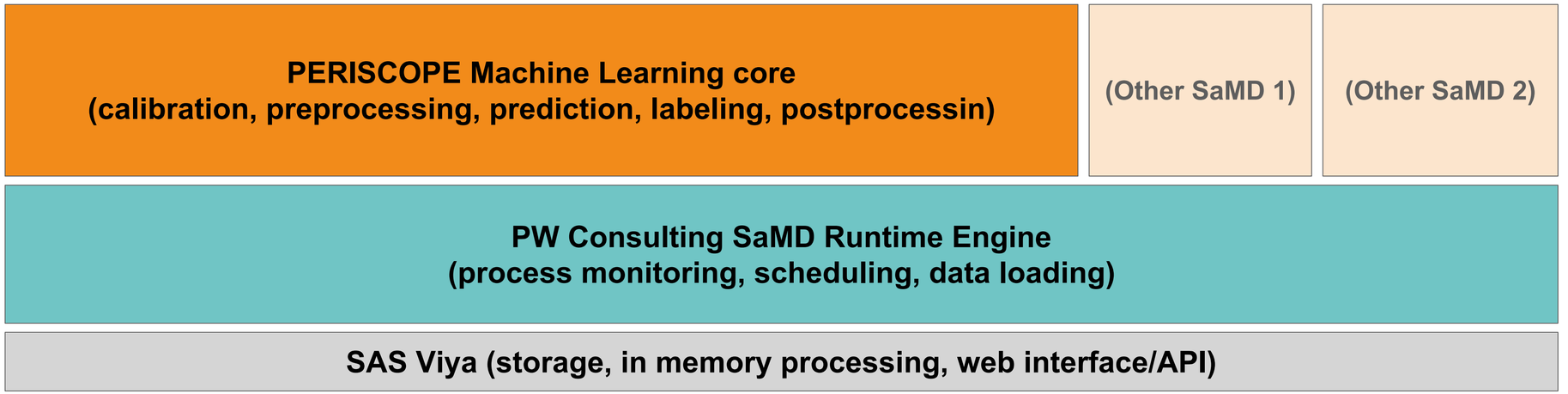
Development strategy

Python first



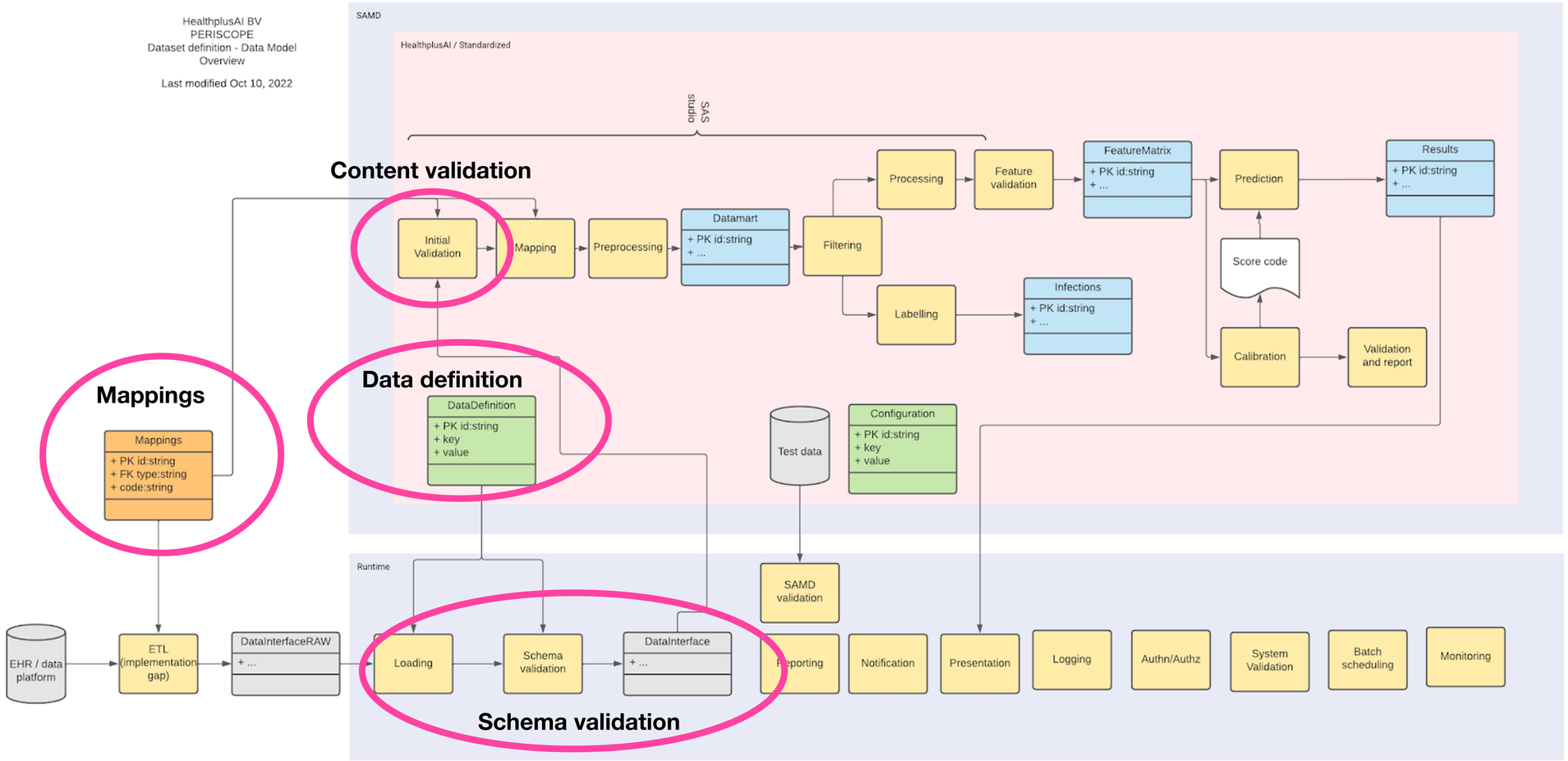
Zooming in on the ML core

Separating concerns



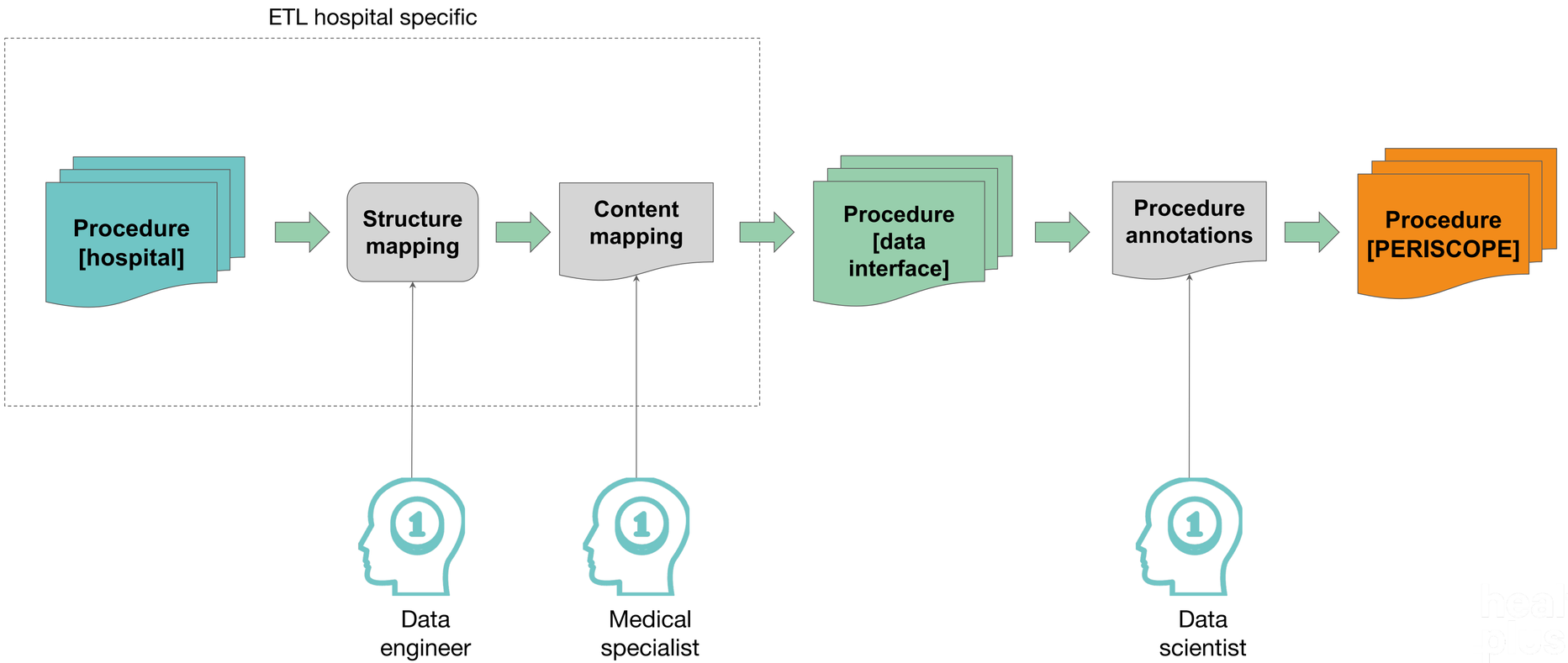
Data validation

Monitoring the conformity of the data, two step approach



Content mapping and annotation

adding meaning to codes



Next steps

Challenges for scaling remain

- Maintenance is key, we are expanding our monitoring mechanisms to signal changes in input data
- Current approach is manageable for small set of hospitals
- Collaboration with EHR vendors and integrators is required to reduce the effort of implementing PERISCOPE
- Additional tooling is being developed to facilitate the mapping process (GUI to help medical specialists, AI to auto map a large portion of the codes)

Explore data integrators

and their role in structural mapping

Collaborate with EHR vendors

to shorten implementation times

Build mapping tools

to speed up the mapping process

LET’S GET IN TOUCH

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