FLIP: Federated Learning Interoperability Platform

A Platform for Deeply Phenotyped and Multi-Modal Studies at Population Scale

RWD85

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AI CENTRE for Value Based Healthcare

Introduction

The Challenge → NHS data is siloed and difficult to share for research purposes due to privacy and policy barriers.
The Opportunity → Raw multi-modal data (text, imaging) from diverse patients is essential for deep phenotyping and AI biomarker development.
Our Proposition → FLIP (Federated Learning Interoperability Platform): an open-source platform for federated research on multi-modal NHS data.

Objectives

Provide a platform for Federated AI Learning across NHS trusts, keeping the data at secure enclaves:
→ Privacy-preserving: essential for healthcare data
→ Scalable: required for training complex models

Interoperability via data harmonisation across sites:
→ Cohort discovery
→ Federated analysis
→ AI model training as a Federated NHS Secure Data
→ Harmonisation audits data quality and missingness

Methods

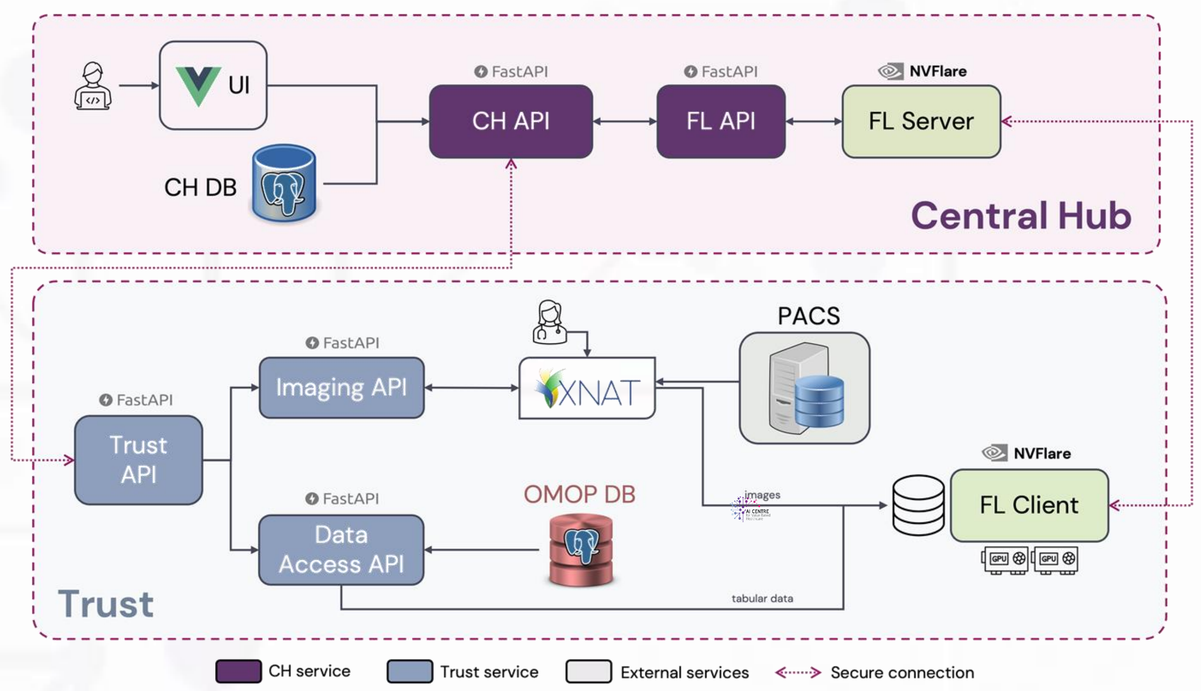
Federated Data Engineering Pipelines → Orchestrated pipelines connect to **>20 NHS source** systems:

1. Structured Data (SQL/dbt)
2. NLP to process text
3. Imaging (metadata extraction, quality control, etc.).
4. Curation to OMOP Data Model

Architecture → Microservice Design

1. **Modular & Adaptable:** Easily adjusts to the unique data infrastructure of different hospitals. Open-Source Foundation: built on established tools including XNAT[1], NVFlare[2], VueJS, and PostgreSQL.
2. **Core Components & Function:**
   Central Hub: Manages user interaction, model assets, and project coordination.
   Trust: Secure interface for federated training coordination between the Central Hub and the hospital data.

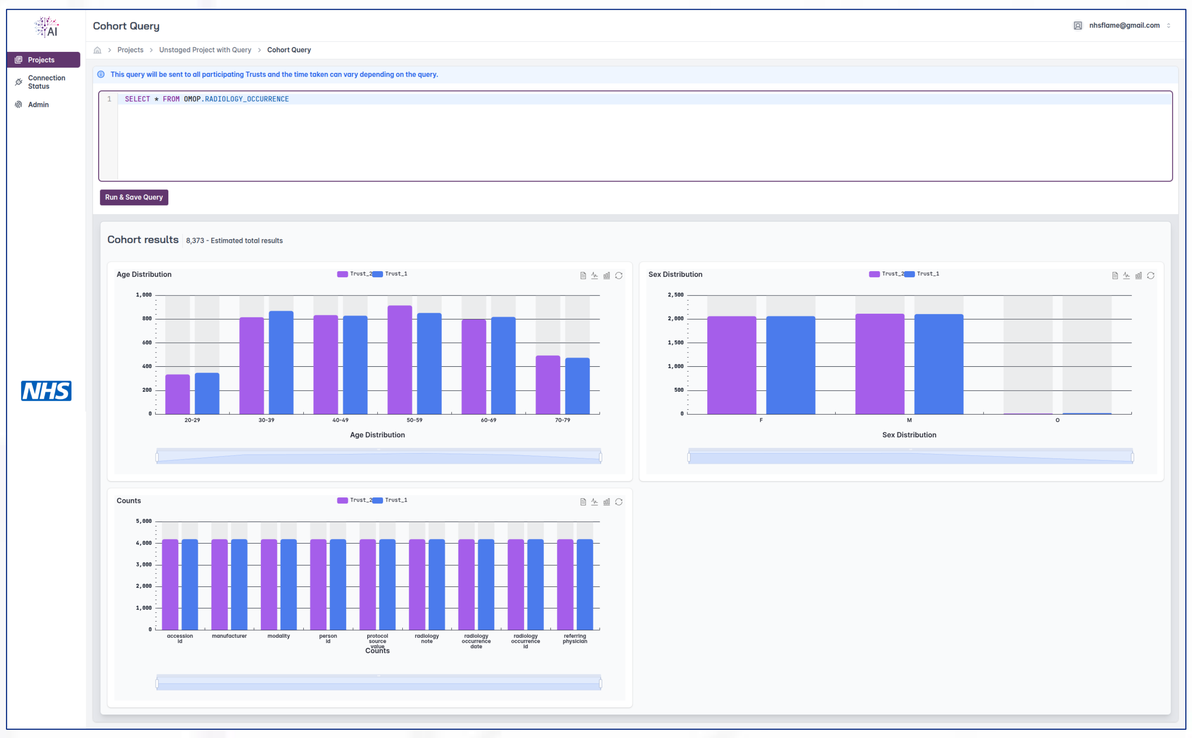
✓ **Data Safety:** Provides layers of decoupling and isolation from patient data infrastructure.
✓ **Highly Scalable:** Architecture designed for high availability and growth with on-demand GPU access.
✓ **Privacy-Preserving:** Secure federated learning workflows.



FLIP Platform Microservice Architecture

Results

FLIP produces validated results in federated classification and segmentation tasks. In real-world deployments, multi-modal pipelines and FLIP give access to full pathway data for 10 million patients across two UK quaternary hospital networks.

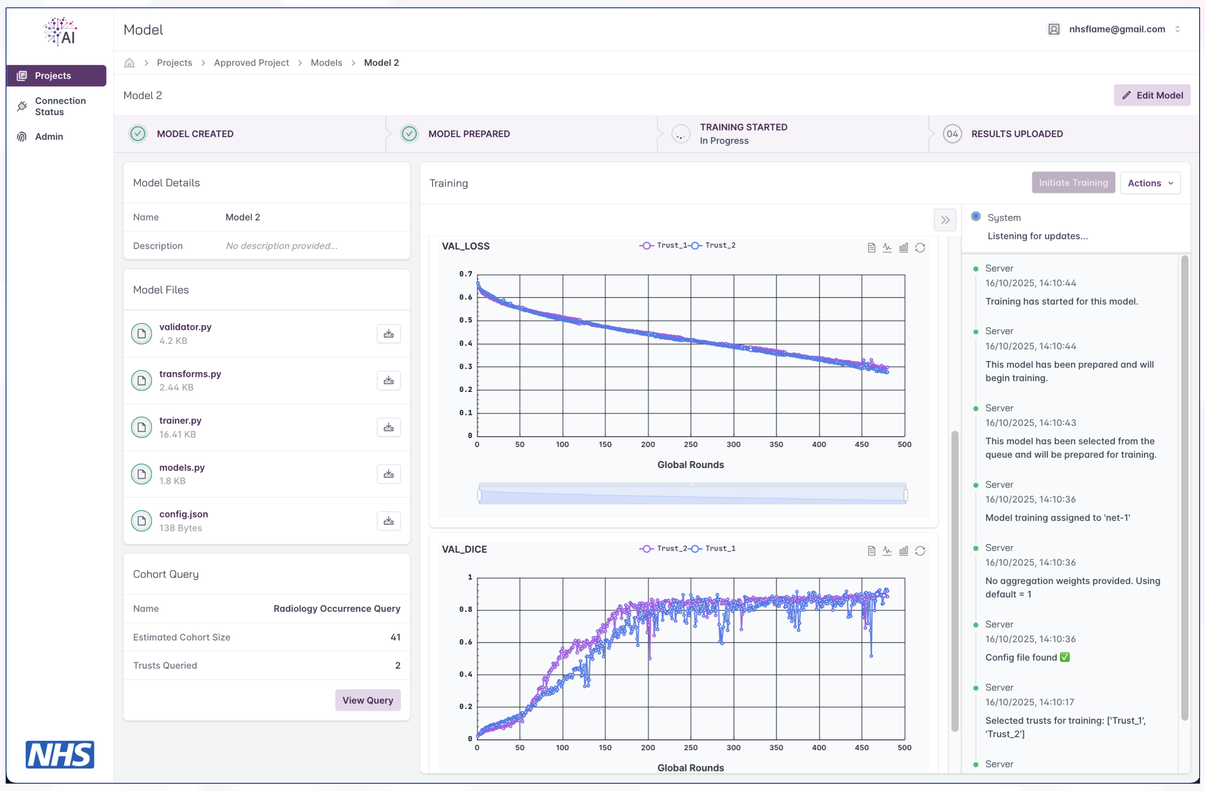


User Interface snapshot: Cohort query across 2 NHS trusts

Conclusion

→ While there is consensus within the ML and healthcare communities on the potential of FL to significantly improve treatment outcomes[3], no system has been successfully deployed in **large-scale** healthcare settings.

→ FLIP provides hospitals with a trustworthy system for securely leveraging their data to enhance patient care.



User Interface snapshot: Federated training of an imaging model

AI Centre | People | Poster | Waiting List | Demo Video

References

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2. Roth, H. R., Cheng, Y., Wen, Y., Yang, I., Xu, Z., Hsieh, Y. T., ... & Feng, A. (2022). Nvidia flare: Federated learning from simulation to real-world. arXiv preprint arXiv:2210.13291.
3. Rieke, N., Hancox, J., Li, W., Milletari, F., Roth, H. R., Albarqouni, S., ... & Cardoso, M. J. (2020). The future of digital health with federated learning. NPJ digital medicine, 3(1), 119.

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