

AIS-SHIELDS

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THE UNIVERSITY OF
SYDNEY

What is the Australian Imaging Service?

Our mission is to increase research reproducibility and drive the adoption of innovative but trusted analysis techniques.

-  NCRIS invested national platform for collaborative imaging research.
-  Integration with imaging facilities and clinical sites
-  Secure, audited data management, access, and deidentification
-  Browser accessible viewing, annotation, & analysis
-  One-click reproducible pipeline library, curated collection and custom developed

AIS Federation View

March 2023

12 nodes
398 users

3 continents
279 projects/collections

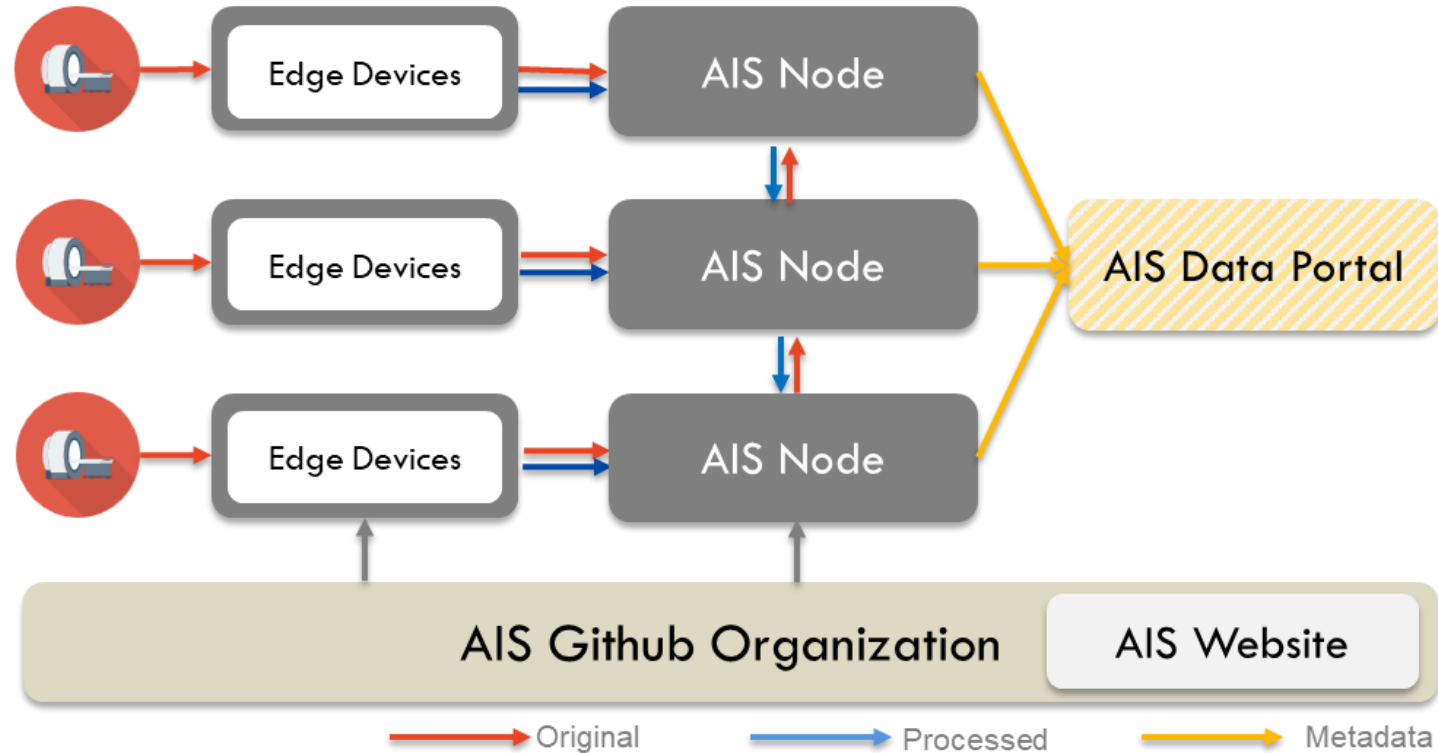
Edge Devices: Upload & process data from clinical sites and imaging facilities

AIS Nodes: Linked data repositories with shared library of containerized pipelines and analysis tools deployed on Kubernetes

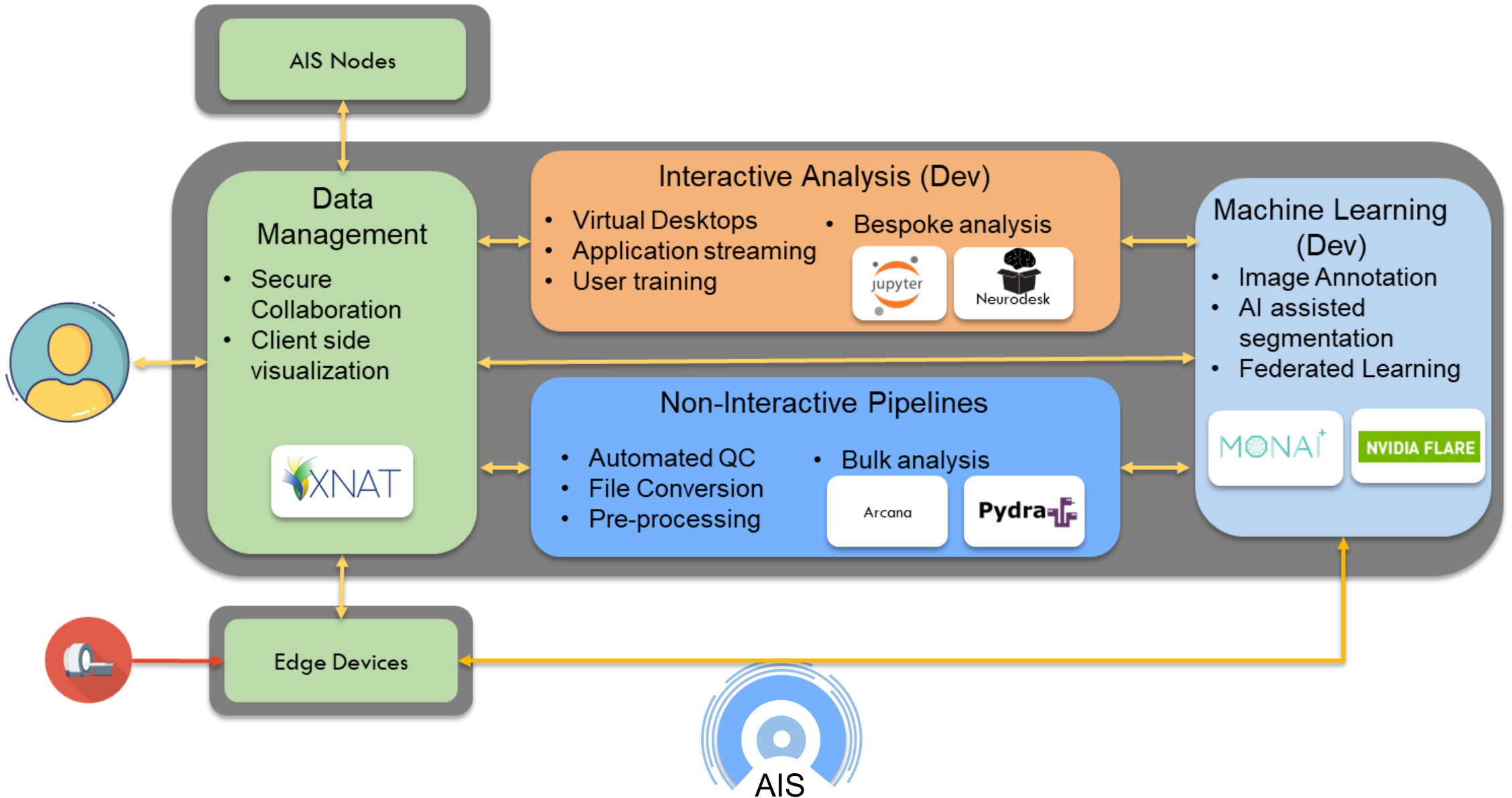
AIS Data Portal (Planned): Open frontend for findable metadata (opt-in)

AIS Website: Single landing page and documentation

AIS Repository: Shared cloud native codebase on Github



Secure Data Centric Computing – 4 Capability Areas



AIS Infrastructure Program

De-Identification approaches

- Integration with Neurodesk
- Support for Electrophysiology data

Discovery Activity
2019

AEDAPT
2021 - 2023

AAF/NIF
Trust & Identity Incubator
2023-24

- Brain Cancer Biobanking imaging

BCI
BCBA
2024-27

- Pre-clinical imaging
- Standardization with international partners

[Embargoed]
2024-25



AIS
2020-2023

- Initial Technical Underpinning
- Birth of the Federation



AIS Pipelines
Expansion
2022 - 2024

- MRI/Neuro
- PET/Molecular Imaging



NCRI
AIS-SHIELDS
2024-27

- Integration with REDCap & BioCommons
- Privacy Preserving NLP and FL tools
- Support for microscopy & genomics data



AIS Infrastructure Program

Wed 11 – Lighting Talk

Brain Cancer Biobanking imaging

- Pre-clinical imaging
- Standardization with international partners

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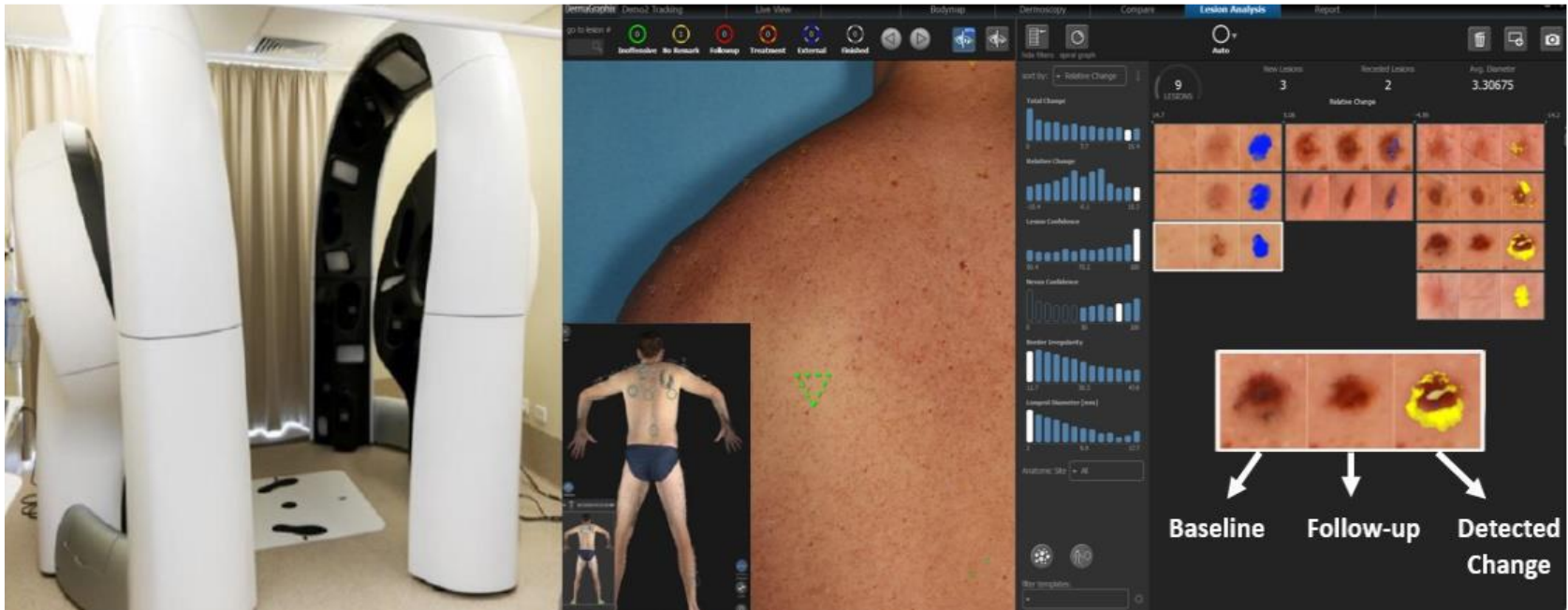


Fri 9 – Kubernetes workshop

This Talk!

Melanoma – Australia’s Cancer

In Australia, it is estimated **that two out of three people will be diagnosed with skin cancer by age 70**, with an estimated 17,000 cases of invasive melanomas and 28,000 in-situ melanomas to be diagnosed this year alone. Skin cancers require >130,000 hospitalizations/year, cost over \$1.7 billion/year, and take an extensive personal toll on patients and their families.

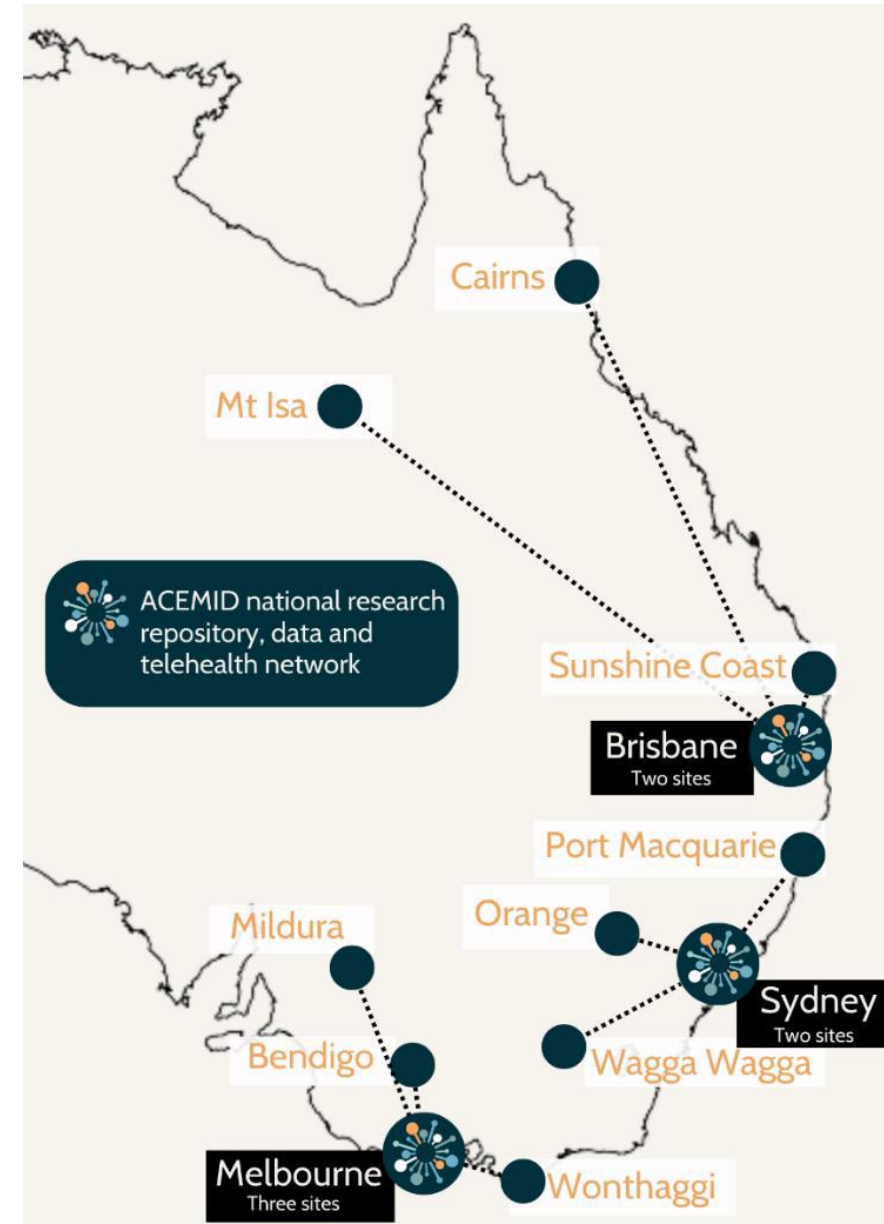


ACRF ACEMID

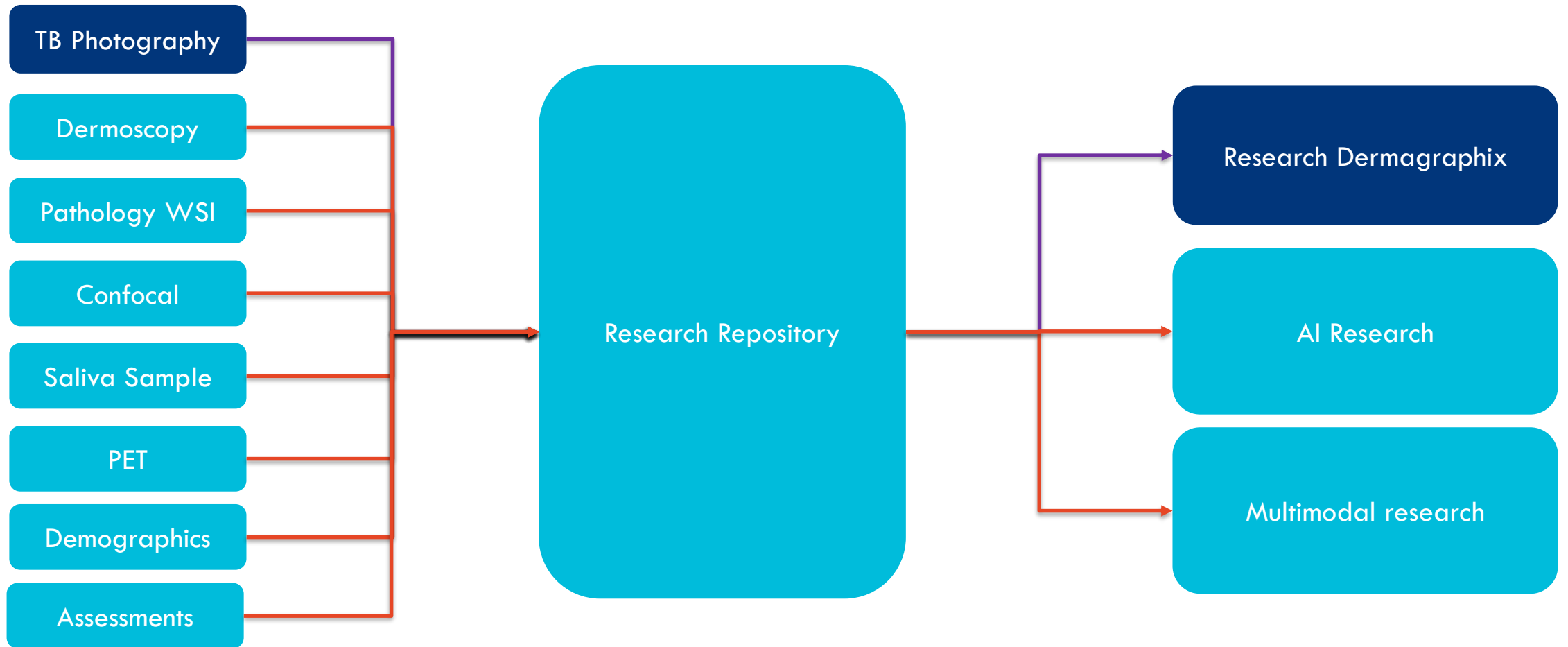
ACRF Australian Centre of Excellence in Melanoma Imaging & Diagnosis (ACEMID) is a national screening program across 15 sites in QLD, NSW, & VIC.

Two technology gaps were identified holding back the impact of the program

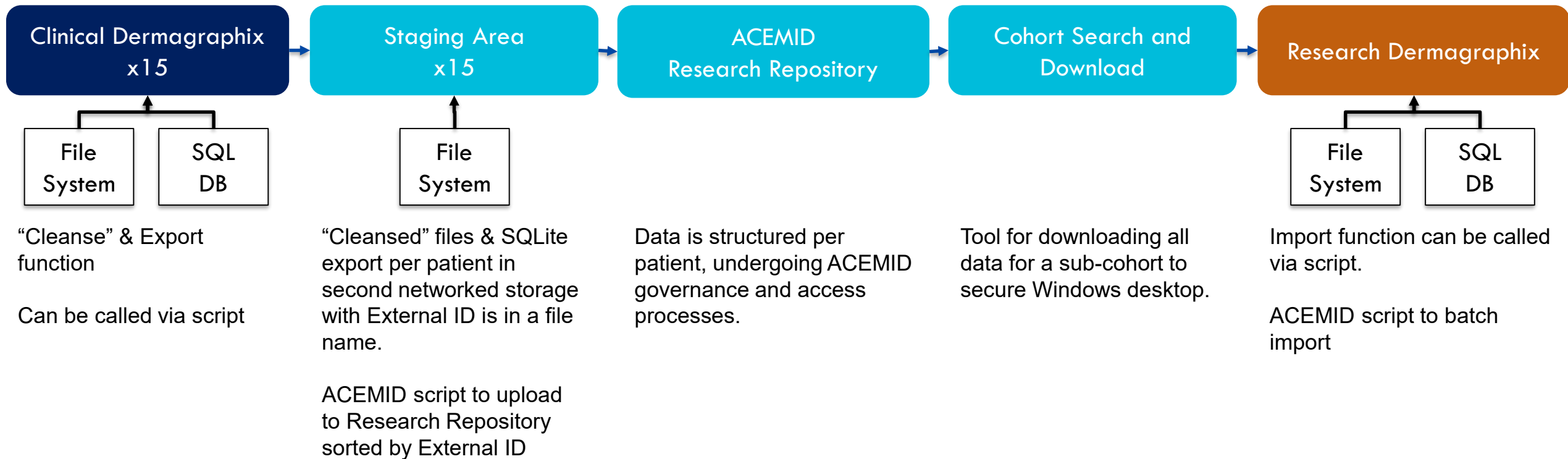
- Individual imaging modalities are siloed, using non-standard formats and separate software platforms, precluding their combined linkage.
- Images are inherently identifiable and sensitive (patients are nude or semi-nude), raising significant privacy concerns for patients, affecting their willingness to participate in screening programs.



ACEMID Research Repository

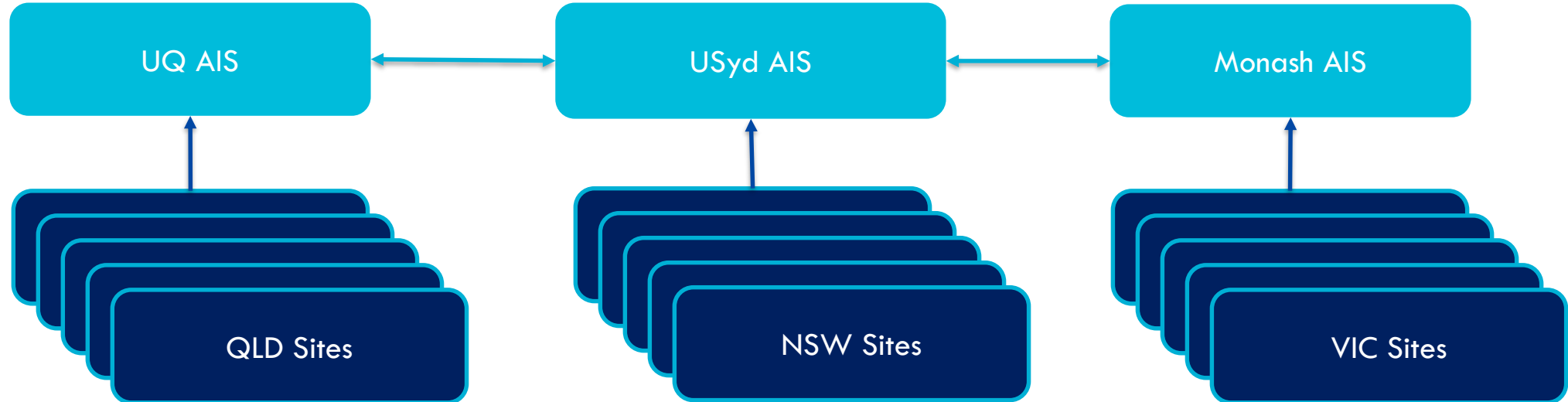


ACEMID Research Repository – TB Photography Data Upload



ACEMID Research Repository – 15 Sites

- 5 visits per site per day
- Need for semi-automated upload to AIS
- Edge Devices act as Staging Areas



AIS-SHIELDS: Privacy Preserving Analysis



Participant Global Unique ID
(GUID)

Federated Learning

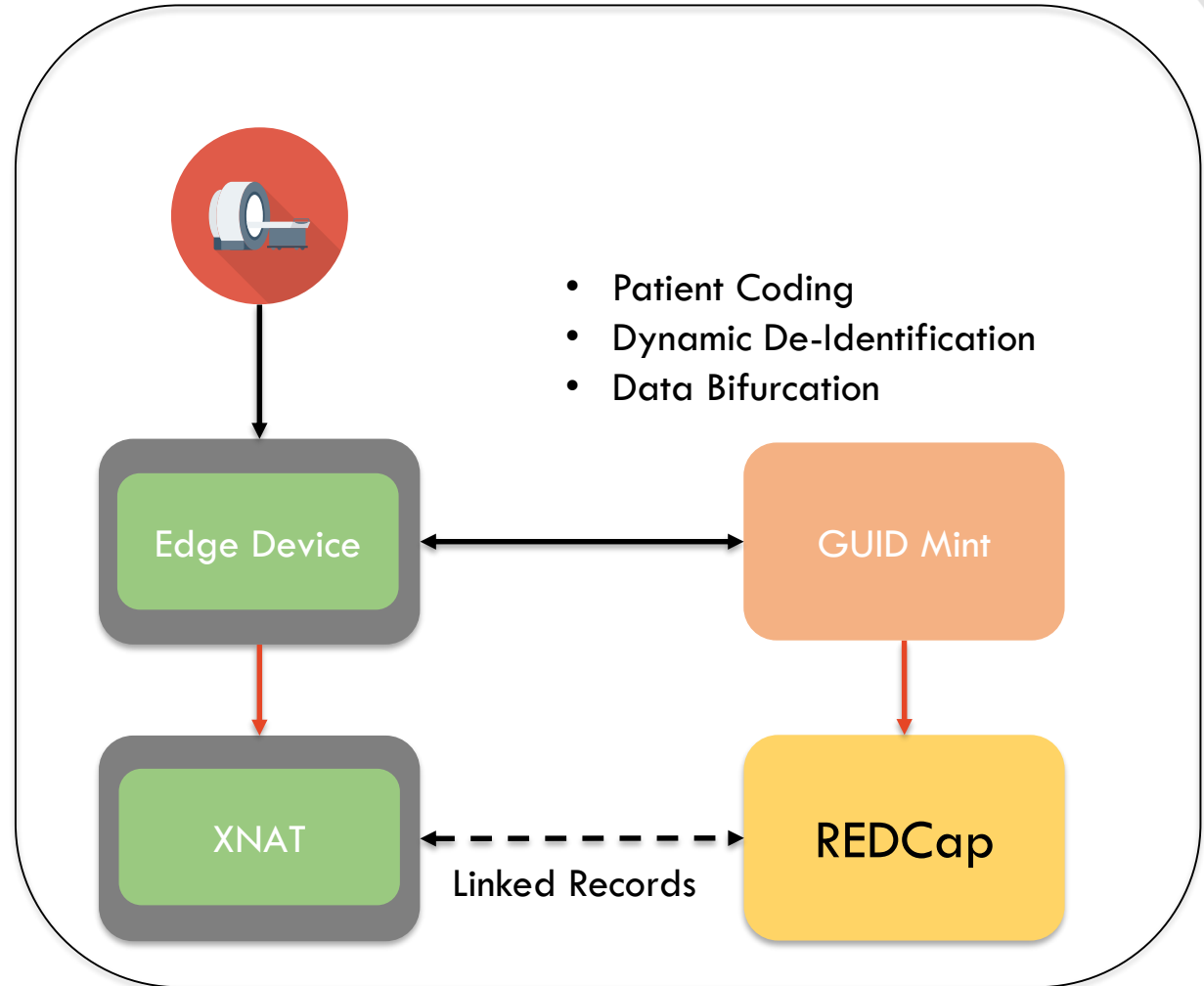
Patient Privacy Risk Profiles
& NLP Detection Tools

Multi-modality Linkage

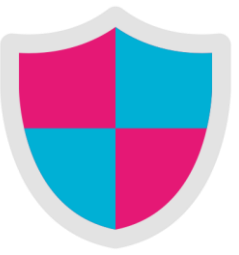


National Participant ID system

- Implement a Global Unique ID service to mint participant IDs
- Based on work by US (NIH) and EU bodies for clinical research
- Allows opt-in linkage across platforms at data creation



Standardized REDCap Integration



Project

Arm

Event

Form

Field

Subject ID Field

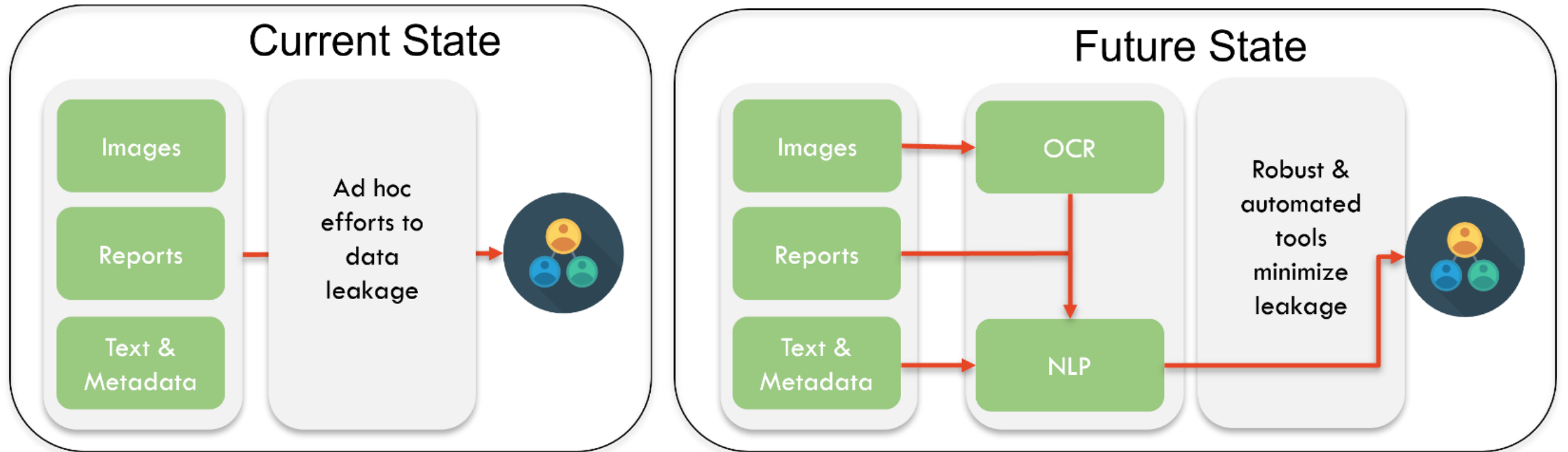
Project

Subject

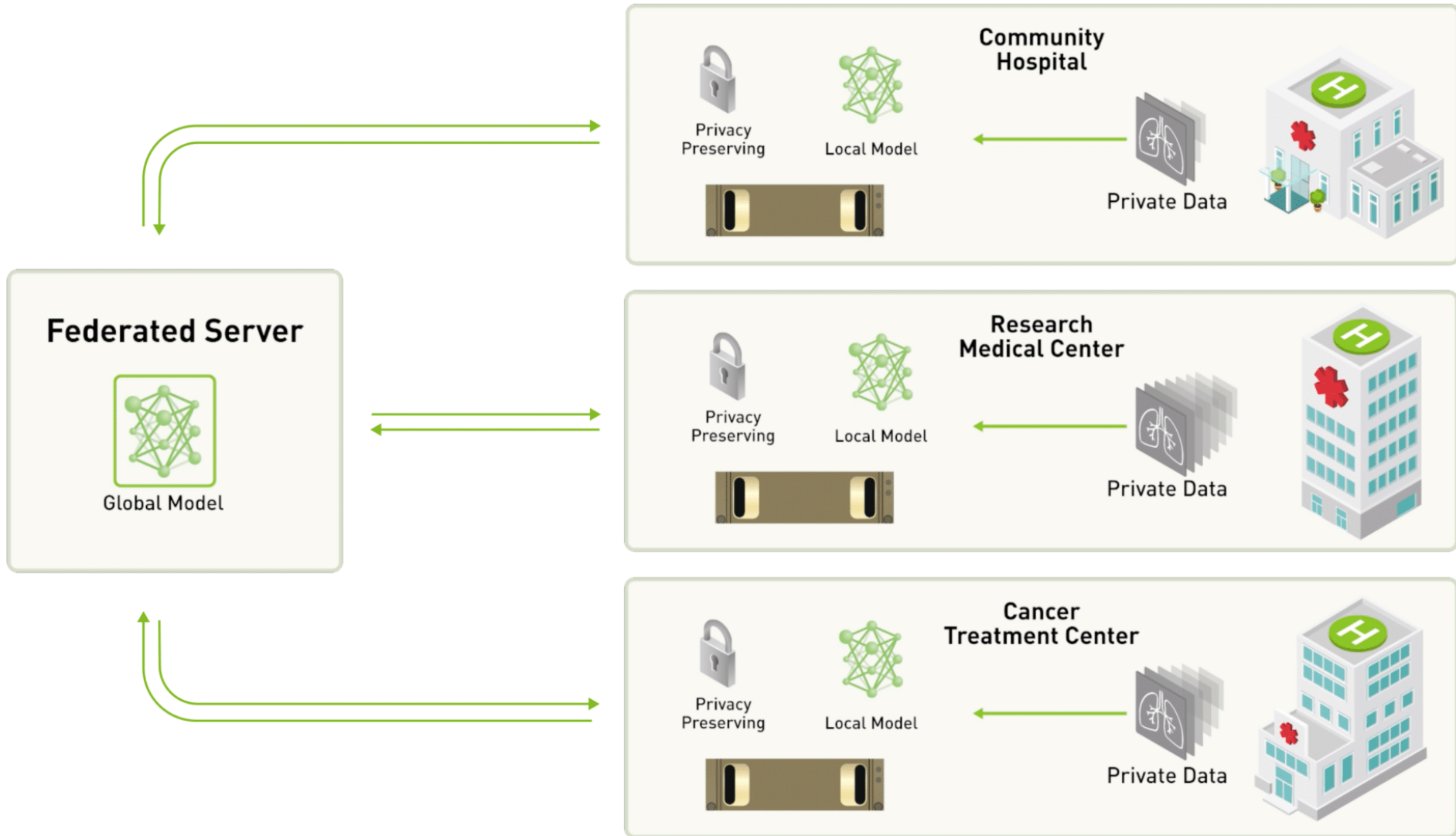
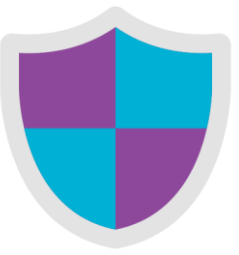
Session

Scan

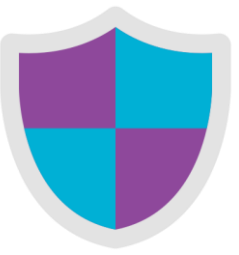
Natural Language Processing Integrated into Pipelines



Federated Learning



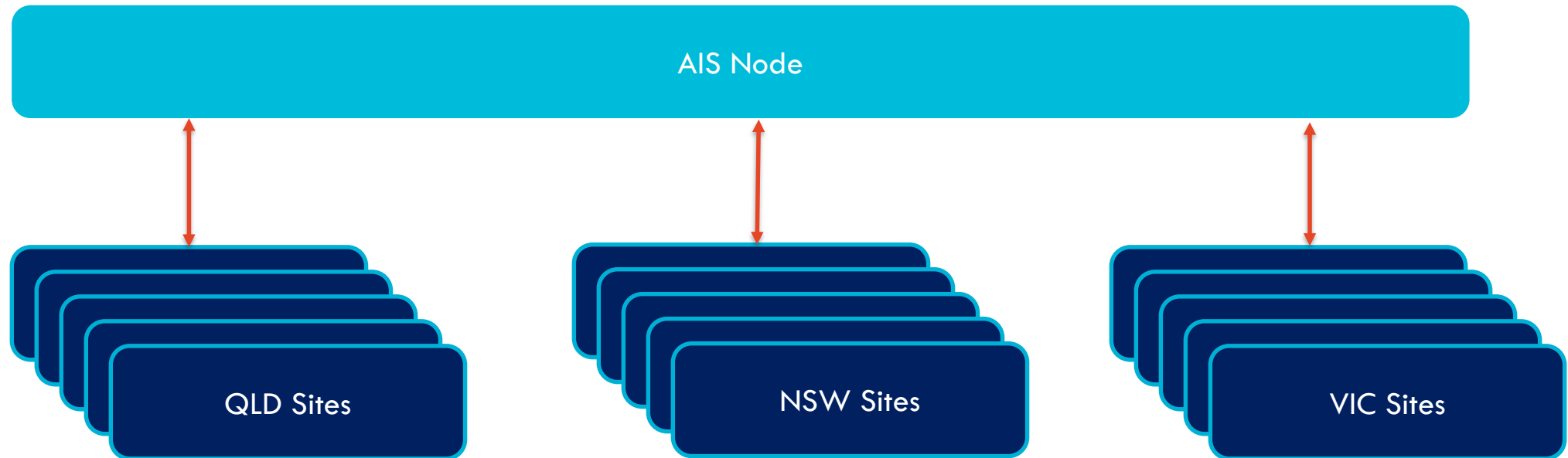
Federated Learning



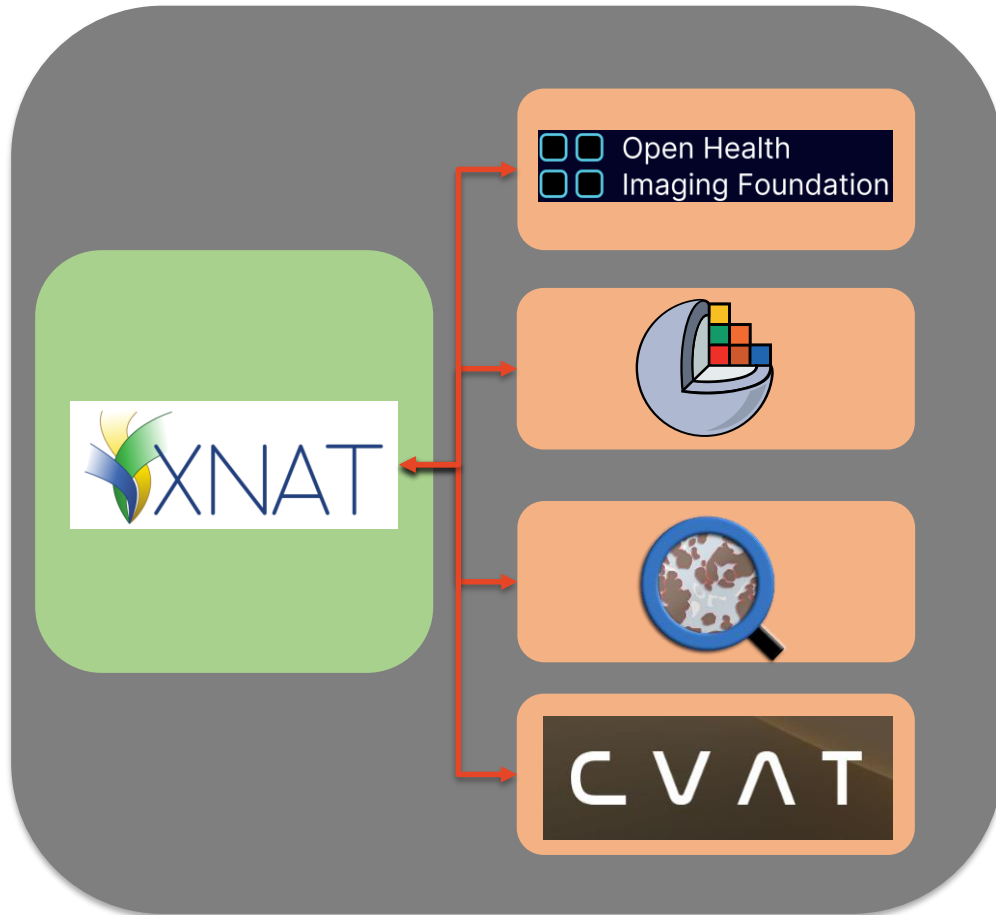
FLERA

Federated Learning Ecosystem For Research In Australia

Transfer model weights between AIS edge devices and nodes. Images never leave the clinical environment



Expansion of Imaging Viewers



Launched directly from XNAT, they run on your data without leaving the AIS node

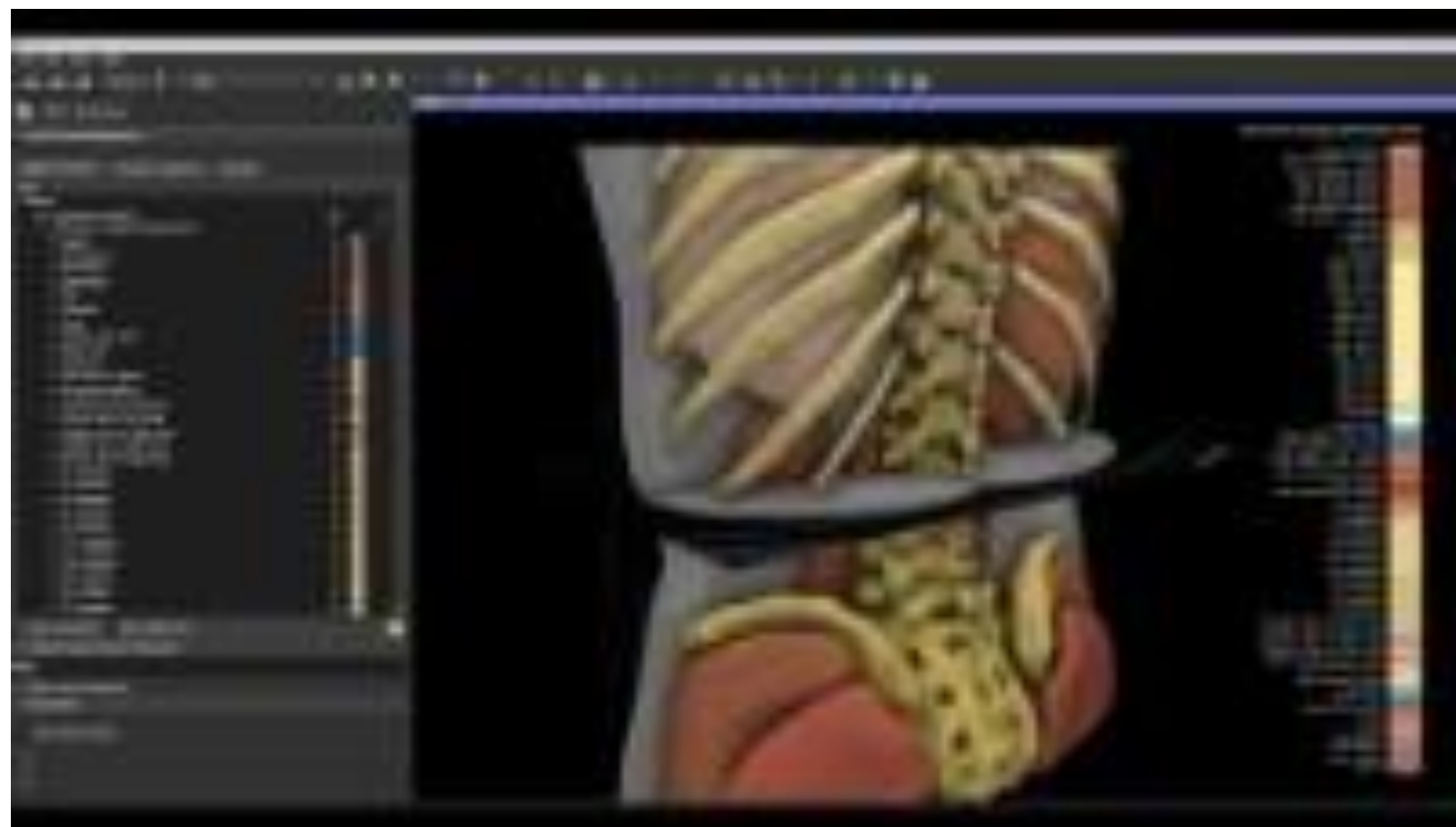
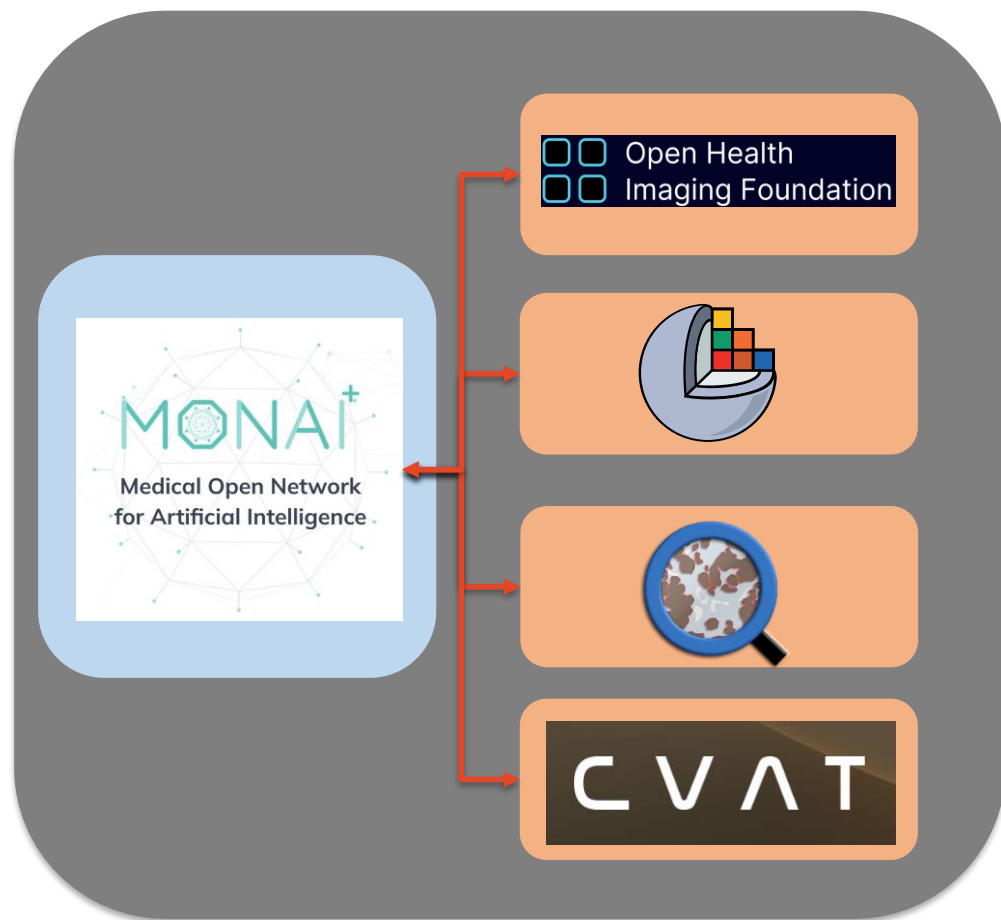
OHIF: Client side DICOM viewer built into XNAT

3D Slicer: Surgery, Radiation Therapy, real time reconstruction

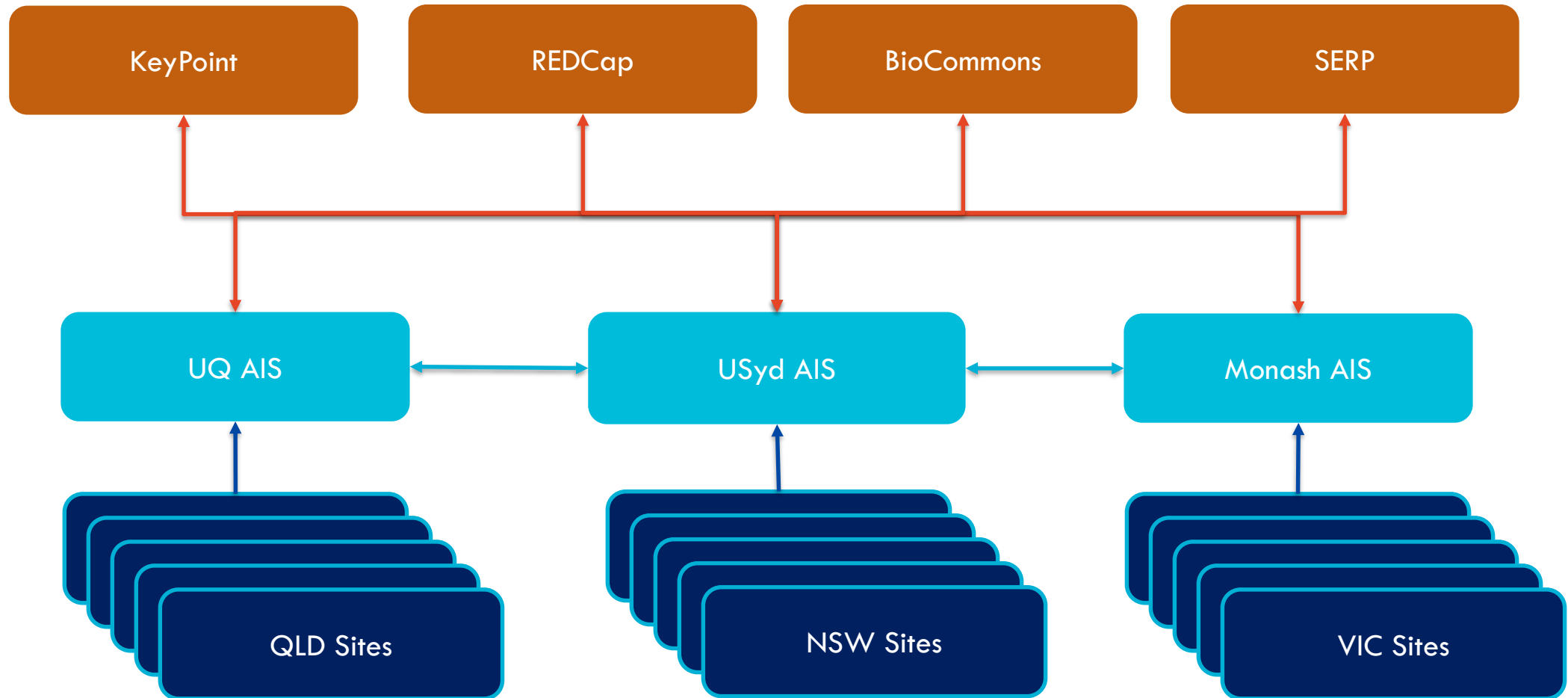
QuPath: Digital Pathology & Whole Slide Imaging

CVAT: External Camera, Dermoscopy, & Endoscopy

MONAI Label Integration with Imaging Viewers



Integration with External Platforms



Acknowledgments

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Dr Aswin Narayanan

Architecture

Chris Albone
Vipul Patel (former)

L2 Support: Erik Shou, Icshan Putra

Docs: David McFarlane

Partners

XNAT Team Flywheel NIF FLERA Neurodesk BioCommons MSBase ACEMID
UQ QUT QCIF UNSW NEURA MQ SAHMRI UWA Monash Swinburne