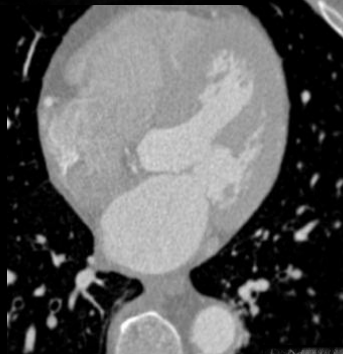
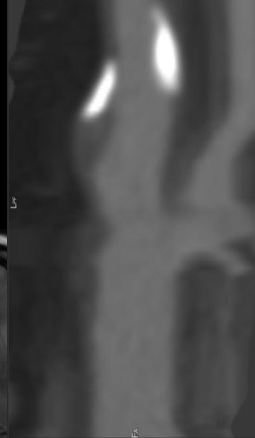
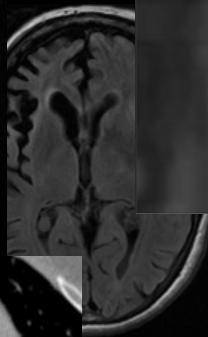
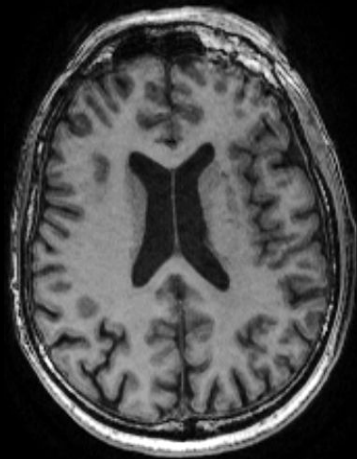
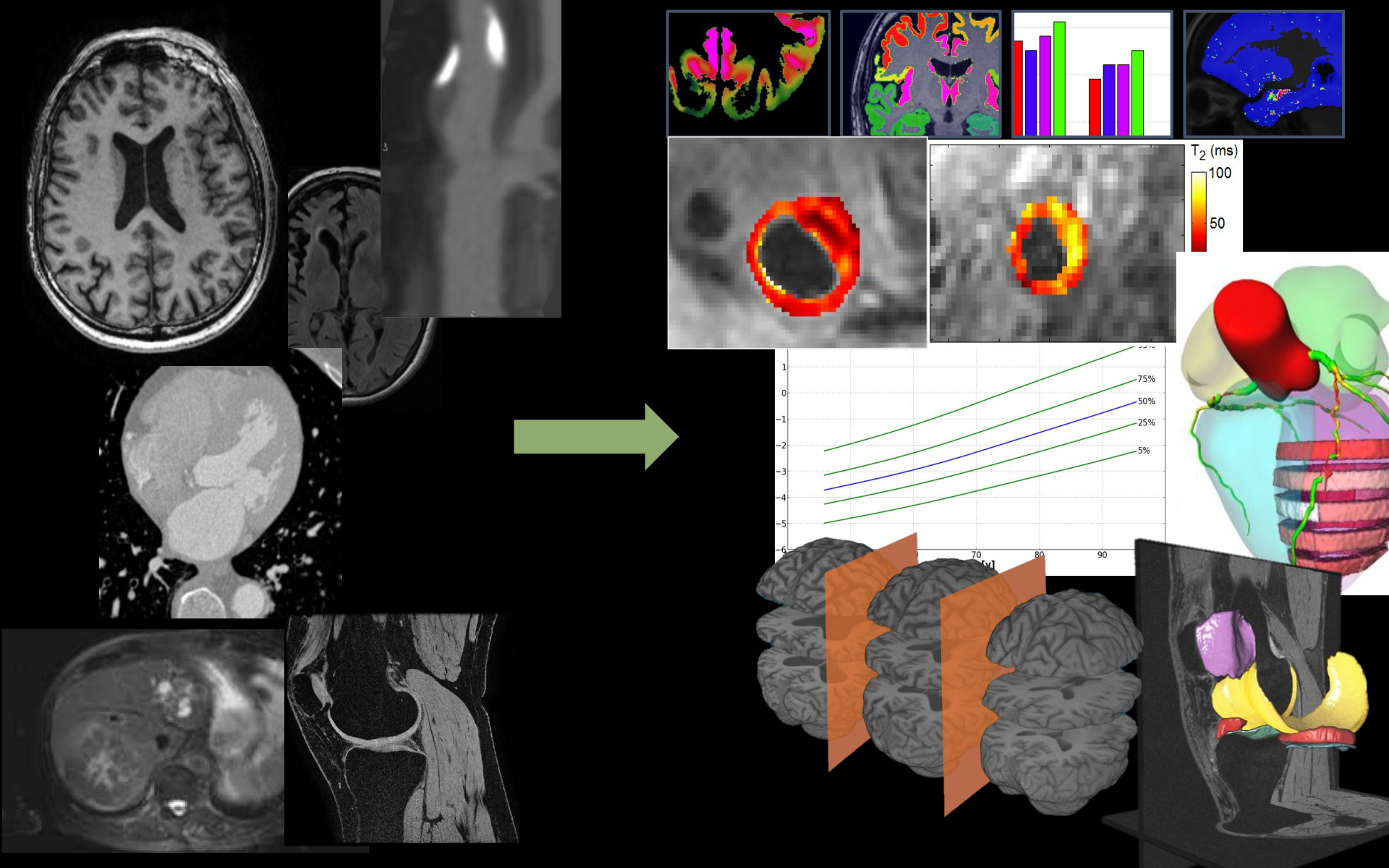


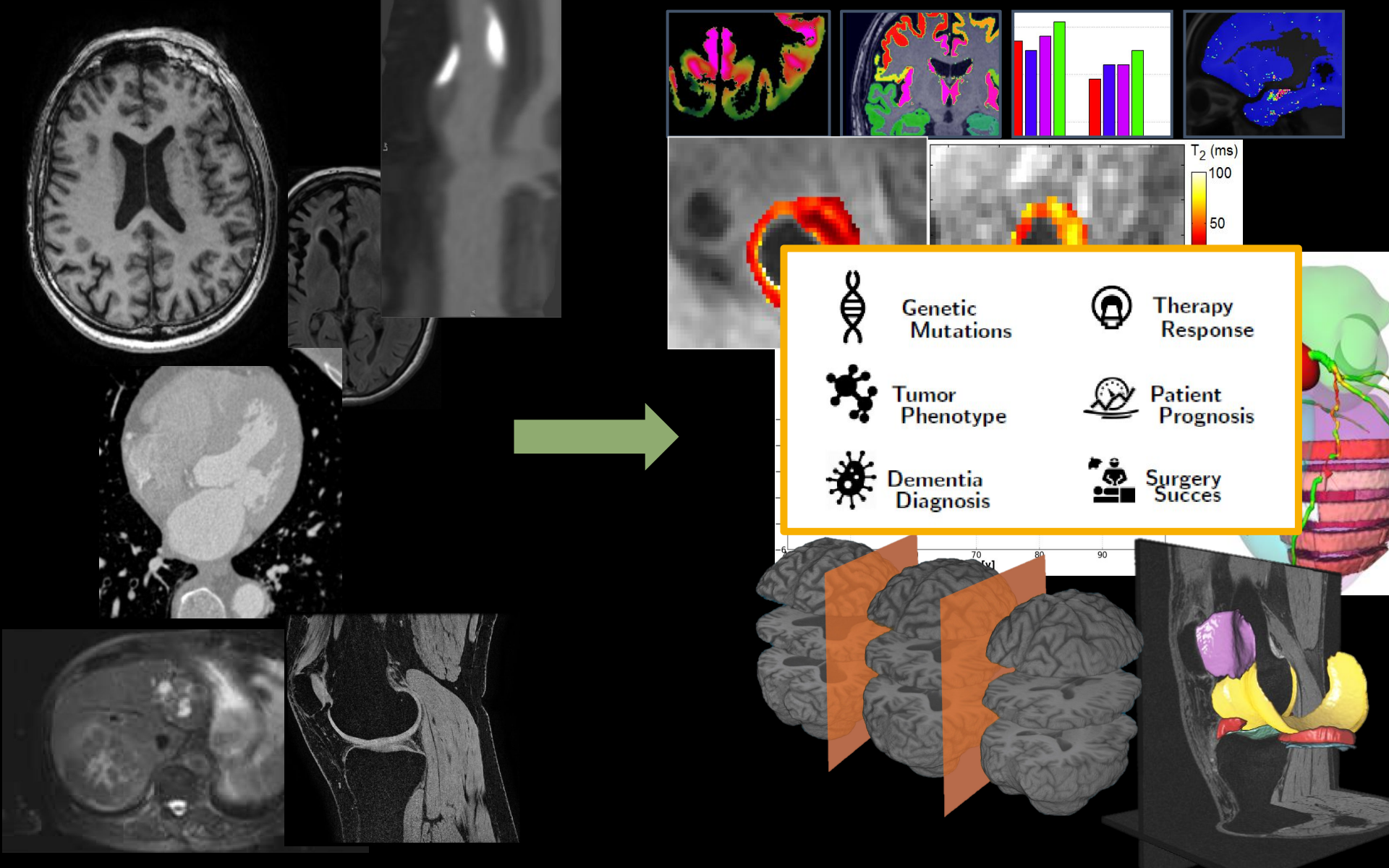
Medical Image Analysis in the Cloud

towards reproducible imaging data research

Biomedical Imaging Group Rotterdam, Erasmus MC
Marcel Koek







Scale-up

- Study running for a long time (data variation)
- Multi-center (even more data variation)
- Number of participants
- Number of researchers

- MORE DATA → Data management is becoming hard
- Reproducibility and research integrity are at risk!

Infrastructure challenges

- Data collection
- Data anonymisation
- Data clean-up & structuring
- Data storage
- Data sharing
- Data inspection & annotation
- Data processing & analysis
- Data integration

traceable & reproducible

Let's formalize & automate

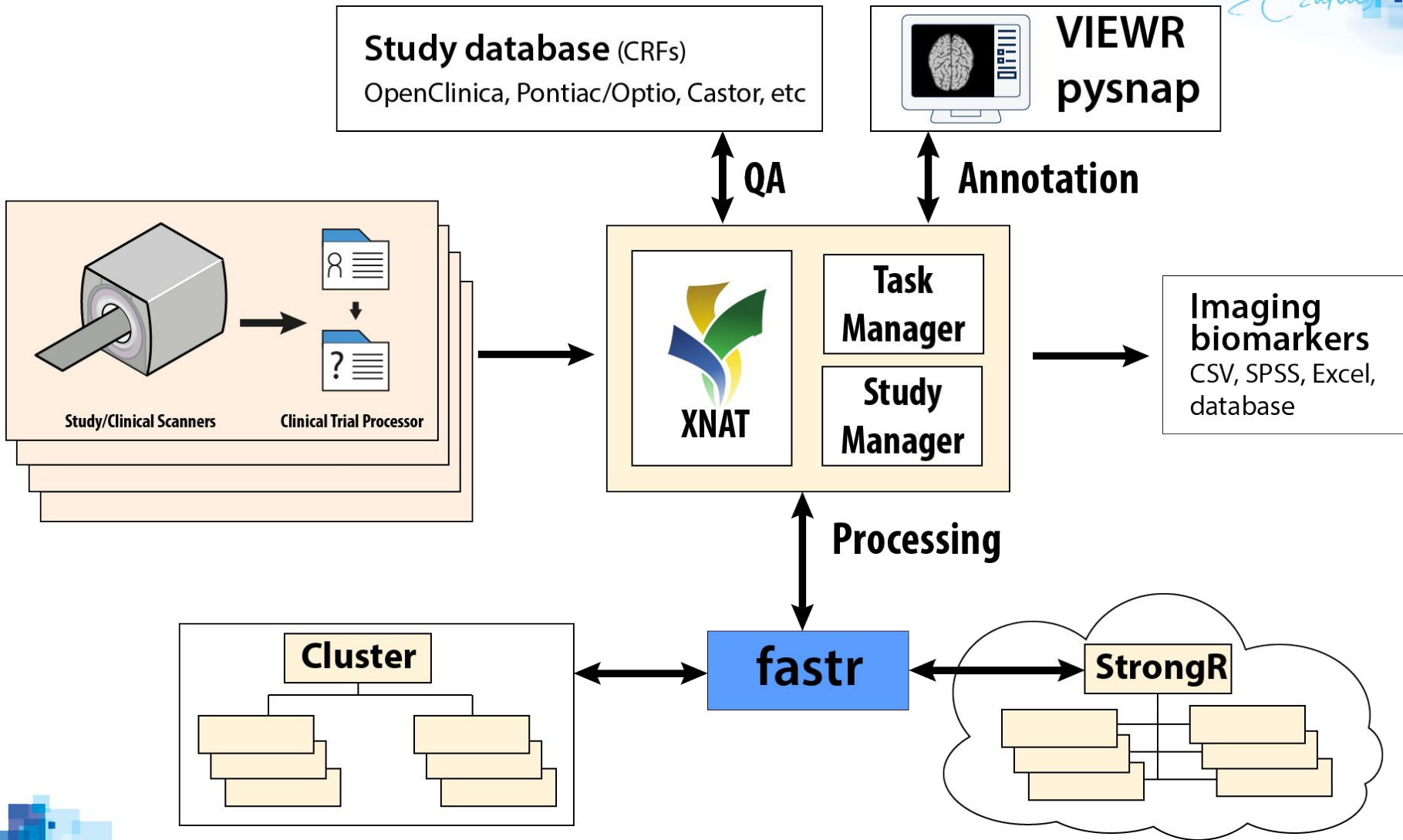
- We have to formalize the data workflow in imaging studies
 - Ensures reproducibility of the results
 - Improves consistency and quality of the data
- Automation can minimize chance of human errors
- Formalization and automation leads to traceability
- This aids scientific integrity

Purpose

- Provide a framework to conduct reproducible medical imaging studies
- This framework consists of:
 - IT infrastructure
 - Software services/tools
 - Knowledge

INFRASTRUCTURE COMPONENTS





Software services & tools

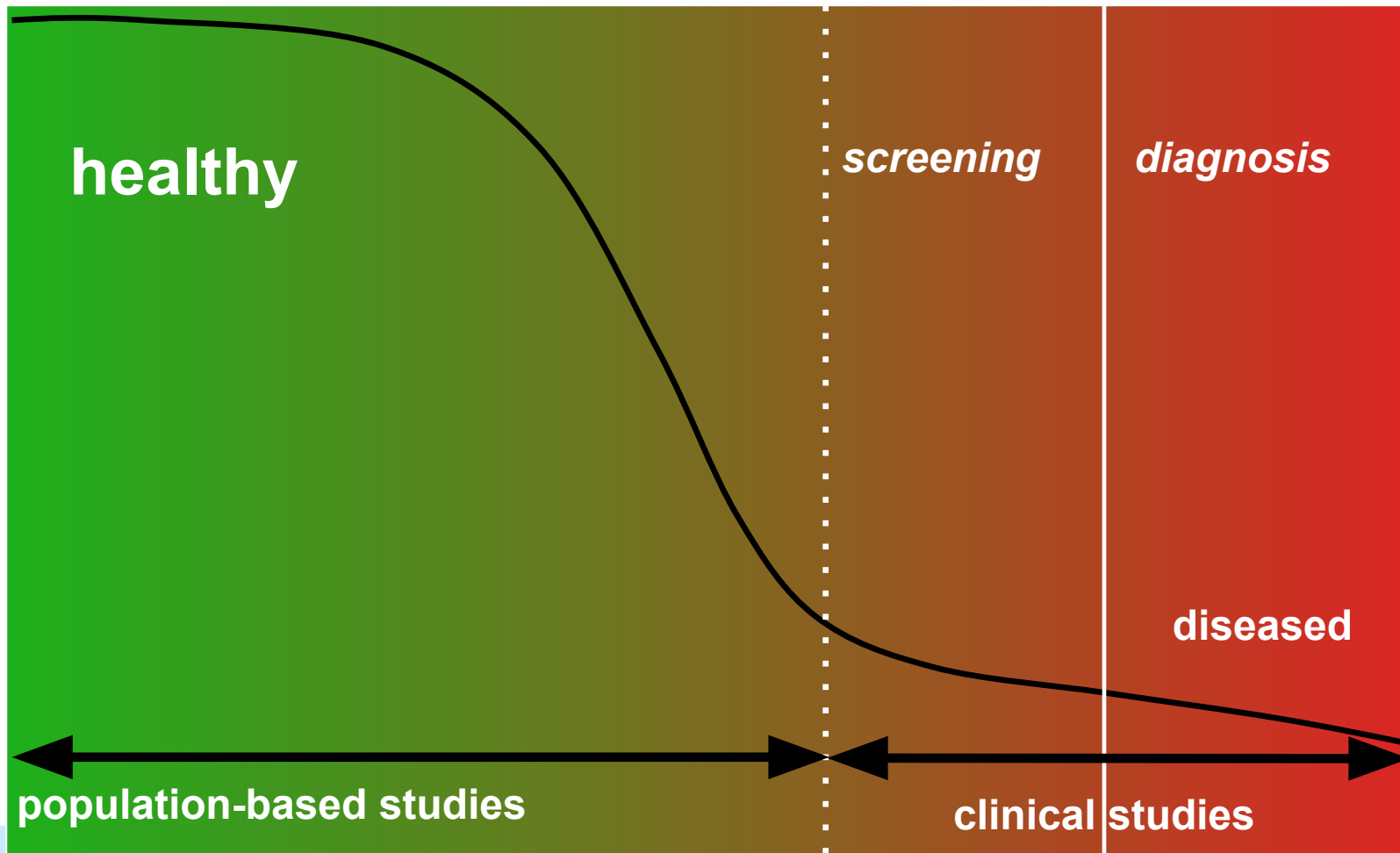
- CTP for data transport and anonymization
- XNAT for image storage
 - xnatpy python package
- fastr workflows
- StrongR elastic cloud processing
- Studymanager (Syncotron)
- Taskmanager
- ViewR



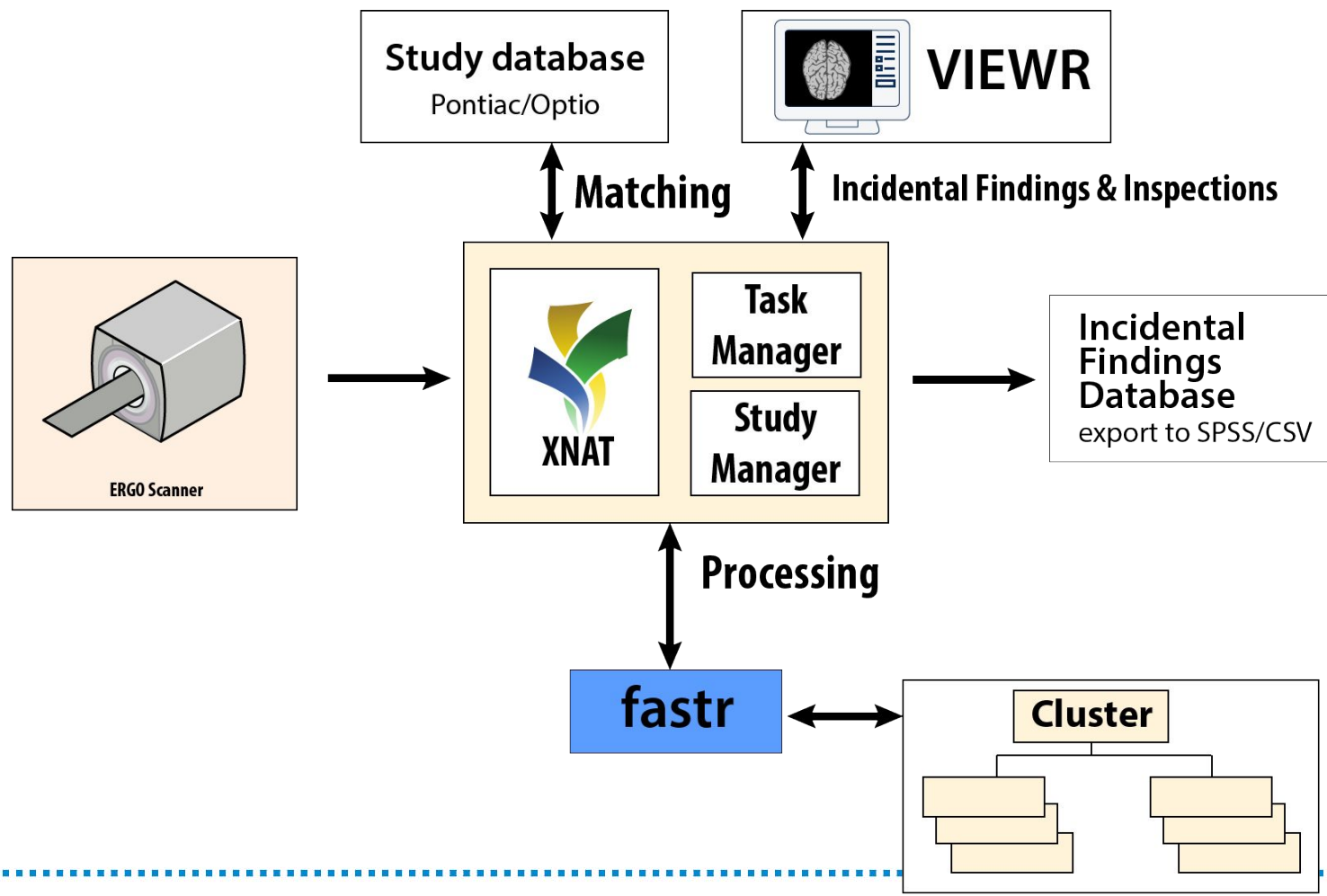
ROTTERDAM SCAN STUDY



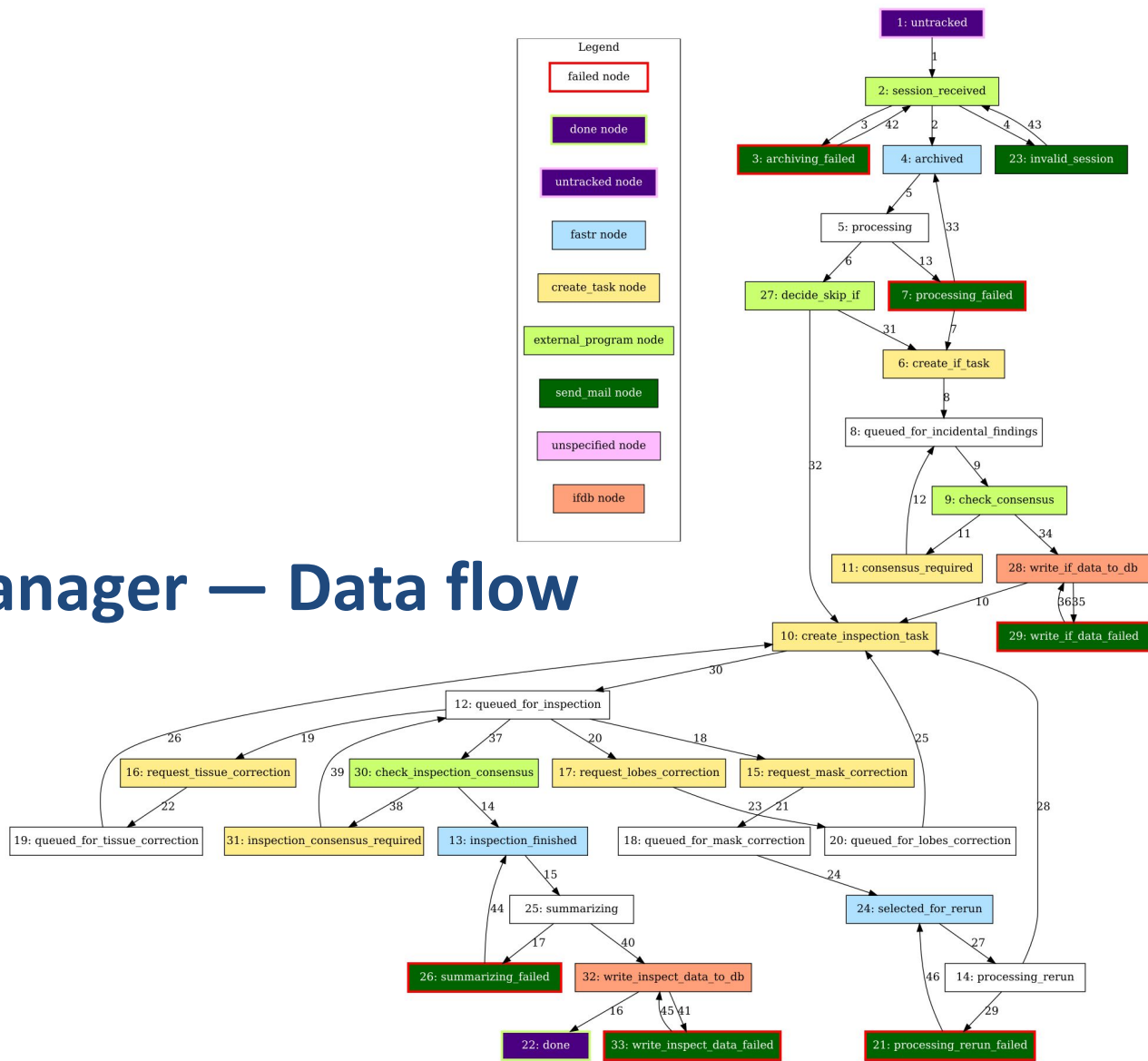
Population Imaging



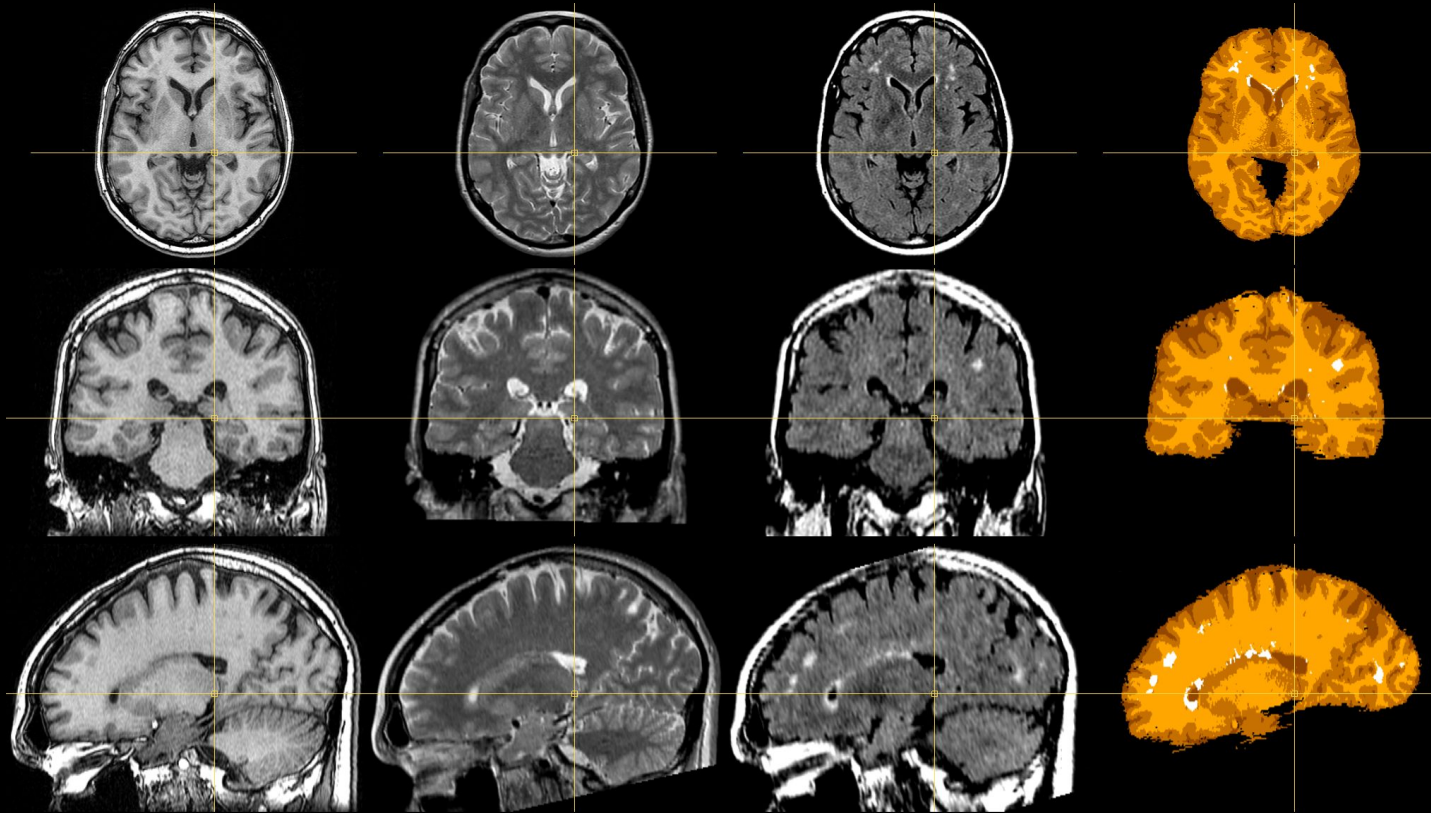
Rotterdam Scan Study



Study Manager — Data flow

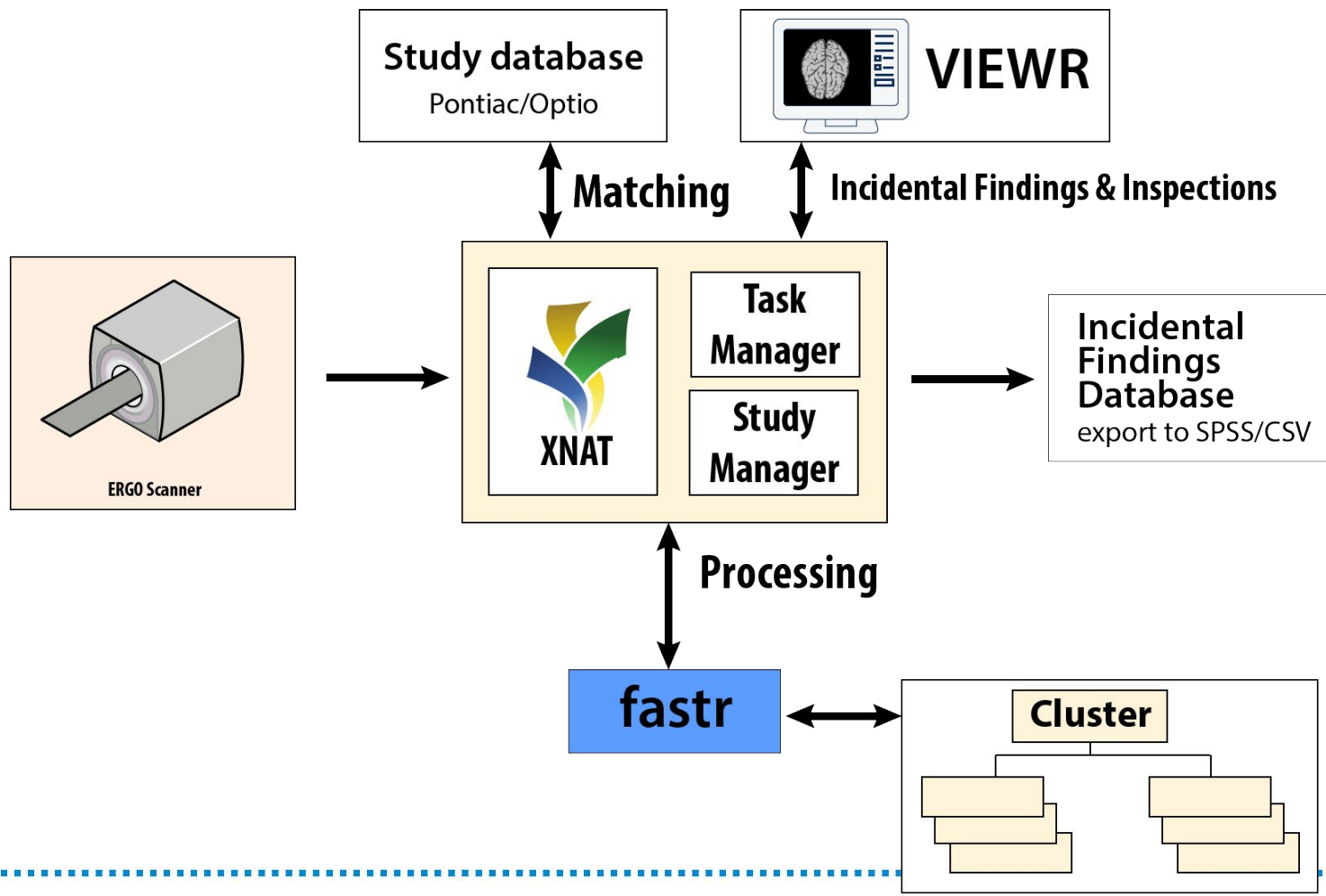


Automated segmentation grey/white matter, CSF, WML

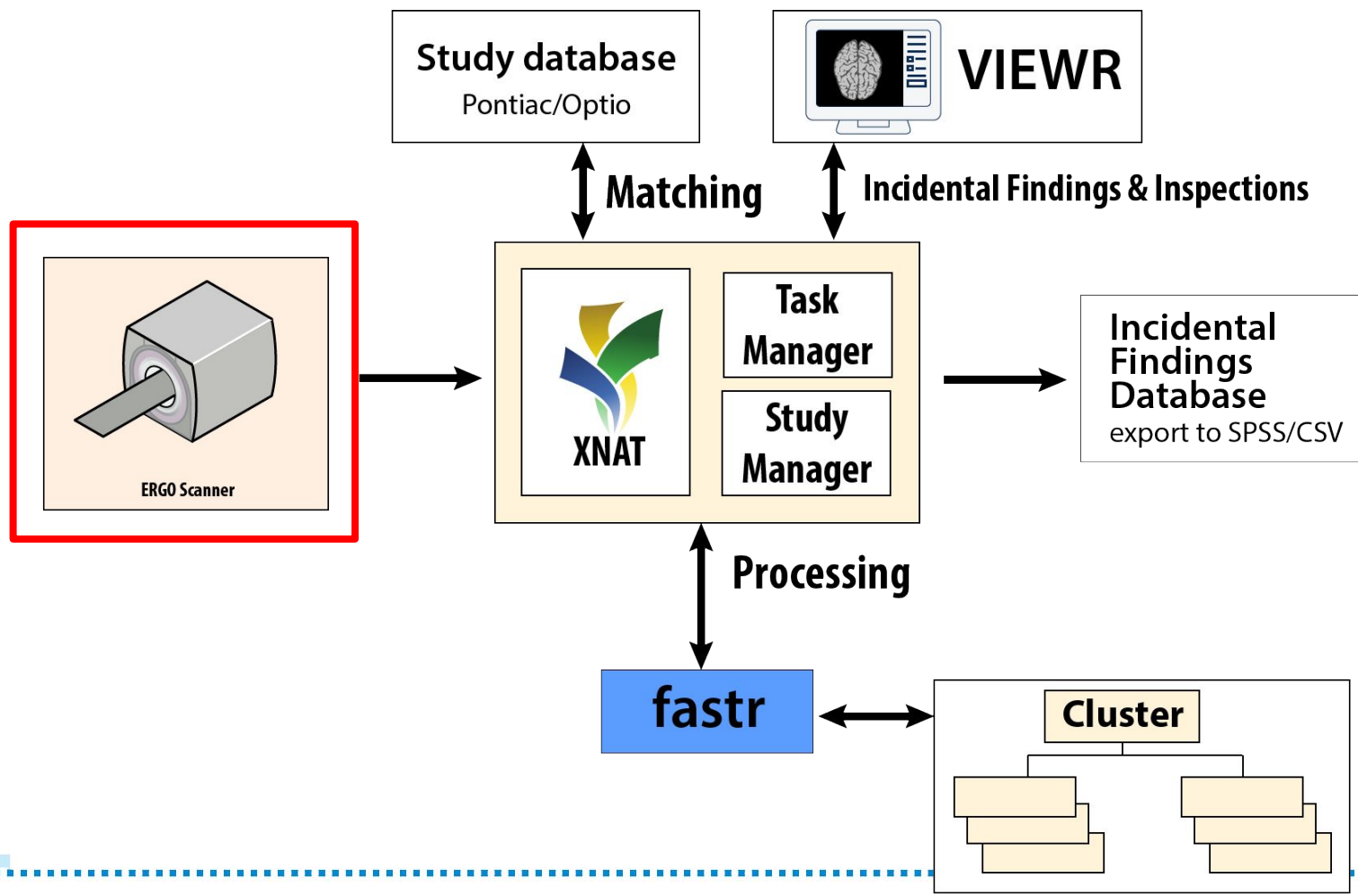


(Cocosco et al. MedIA, De Boer et al. / Vrooman et al. NeuroImage)

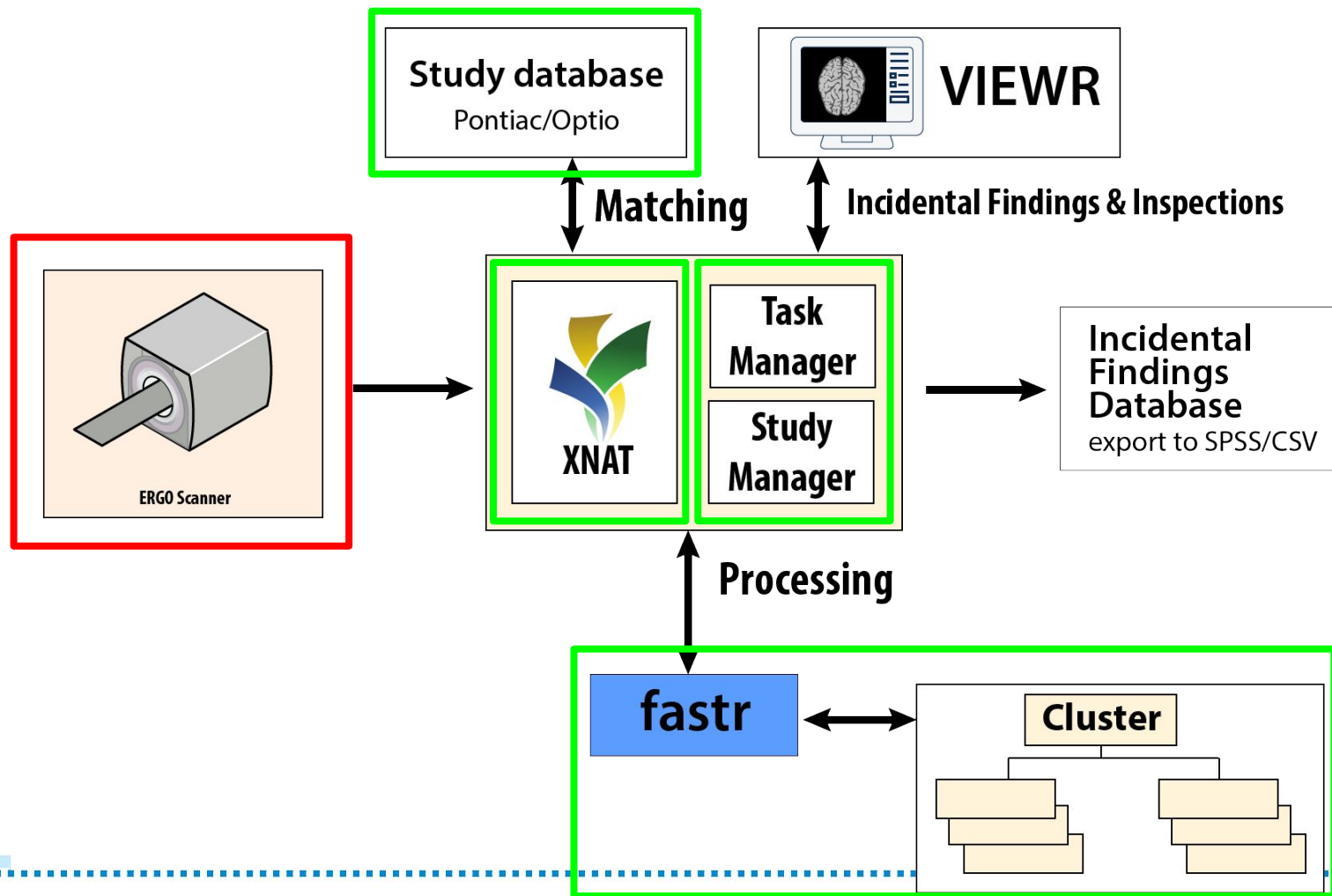
Use Case: RSS -> Cloud



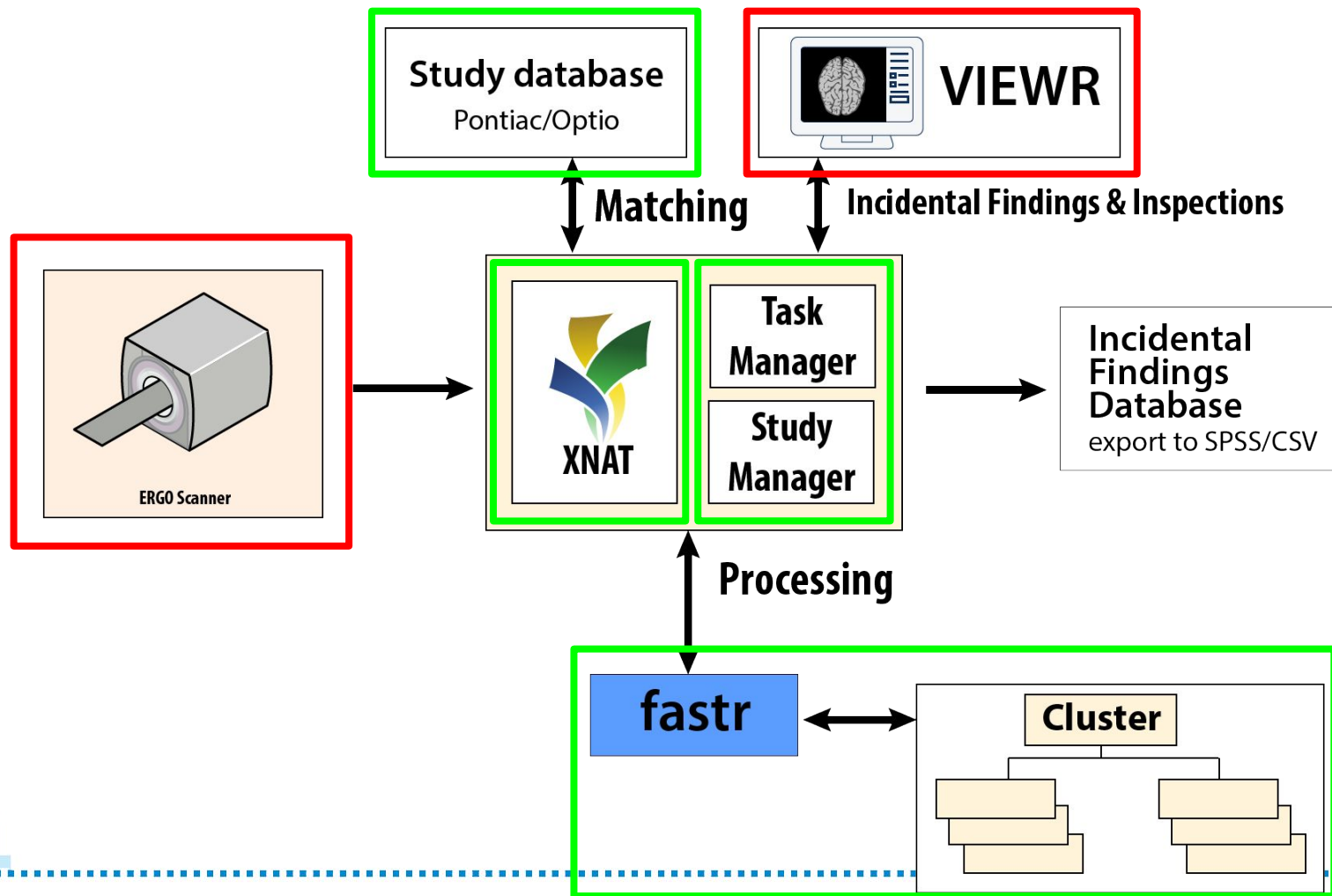
Use Case: RSS -> Cloud



Use Case: RSS -> Cloud



Use Case: RSS -> Cloud



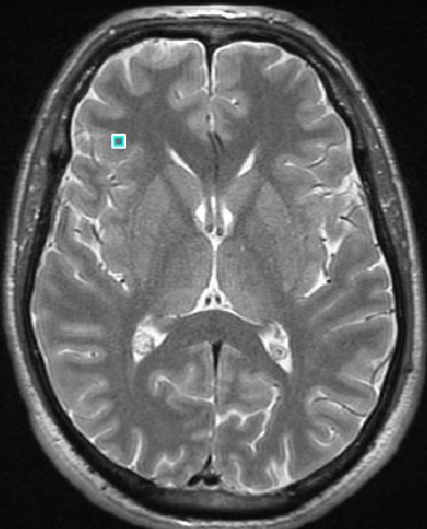
RSS — ViewR

Visual Inspecting and Editing Workbench for Ratings ViewR

8871_2007-01-08 | incidental_findings

PD Transversal T1 Transversal

(498 328 105): 0 A

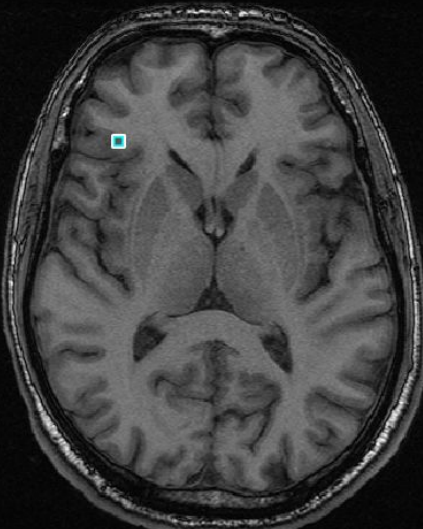


R 100 mm

slice: 105
512,512,192
0.488,0.488,0.800

LUT C/W: 791.5 / 1583

(502 210 105): 0 A



R 100 mm

slice: 105
512,512,192
0.488,0.488,0.800

LUT C/W: 1217.5 / 2435

Incidental Findings* CI Cbl LI MB

Aneurysms Tumors Cysts* Other

cysts

Id	Type	size
0	Thornwaldt	0.0

Selected item Id: 0

x=-161.1, y=-163.6, z=84.0

Type: Thornwaldt

size: 0

request consensus

request consensus description

No cysts present

T1 not usable

PD not usable

FLAIR not usable

SWI not usable

RSS — ViewR

Visual Inspecting and Editing Workbench for Ratings ViewR

8871_2007-01-08 | mask

T1 Sagittal mask all

T1 Transversal mask all

(507 46 171): 35

H

A

slice: 171
512,192,512
0.488,0.800,0.488

LUT C/W: 1217.5 / 2435

(500 18 87): 0

A

R

slice: 87
512,512,192
0.488,0.488,0.800

LUT C/W: 1217.5 / 2435

Quality brain mask

Acceptable Unacceptable

Motion artefact

Implant artefact

Technical artefact

Other artefact

Consensus

Comments:

Research Cloud: ViewR Pilot

- ViewR
 - Client installed application (C++, Qt & Python)
 - Hard to maintain
 - Slow update cycle
 - Hardware dependencies
 - Not always possible to install
 - Hard to reimplement as a web app
 - Solution:
 - Run in Research Cloud

Research Cloud: ViewR Pilot

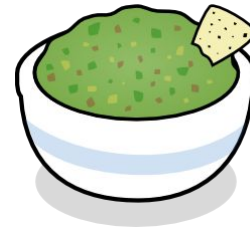
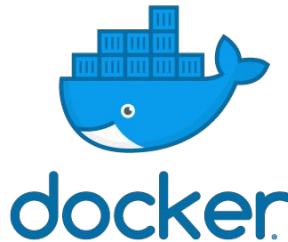
- Benefits of running in the SURF Research Cloud:
 - Centralized — Accessible
 - Possibility to connect to SCZ
 - Possibility for CI/CD type of update/deploy cycles

Research Cloud: ViewR Pilot

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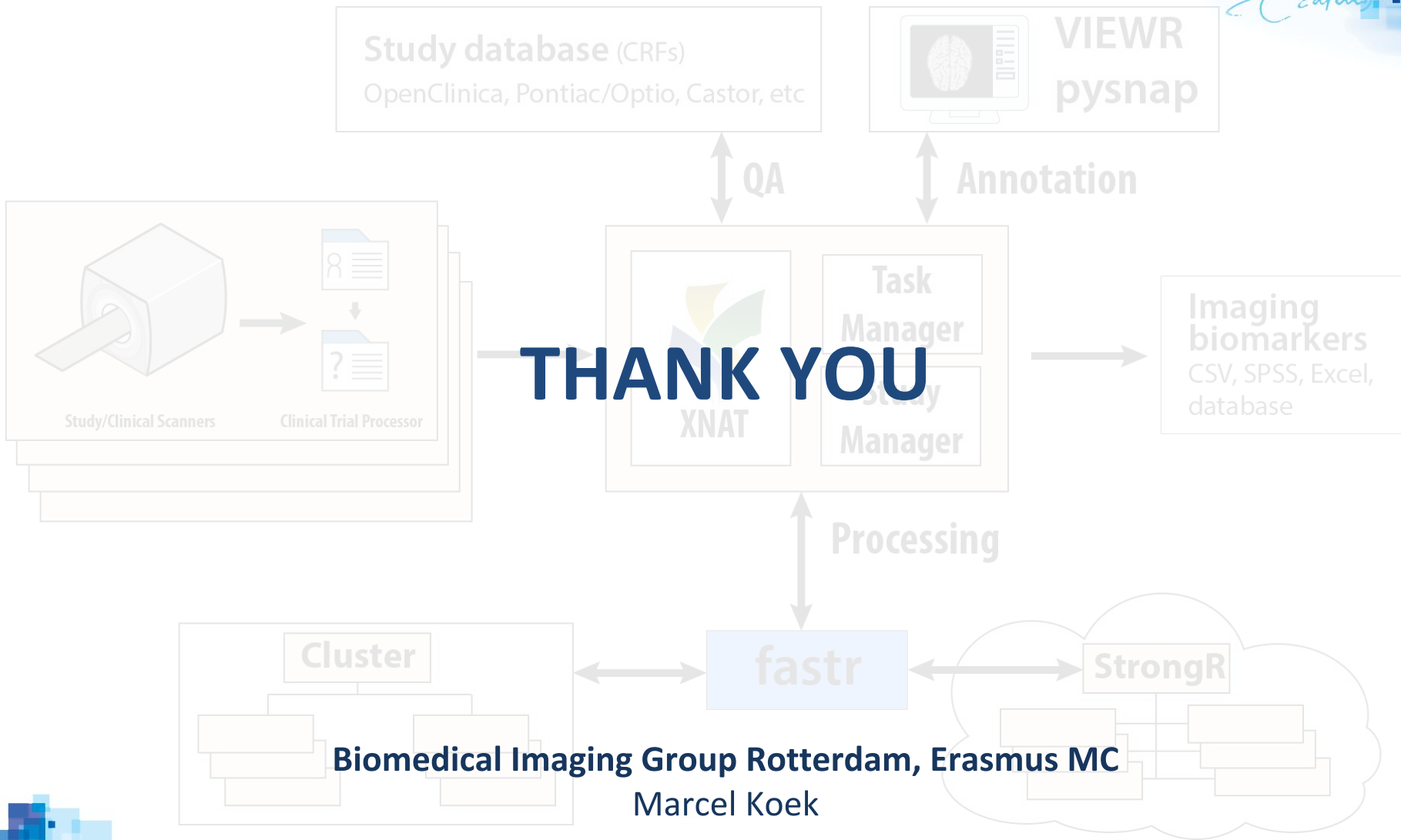


ANSIBLE



Summary

- Functional in-house infrastructure for the RSS
- For multi-center studies
 - Storage in the cloud (Vancis / Surf HPC Cloud)
 - Processing in the cloud (Surf HPC Cloud, Surf Cumulus)
 - ViewR in the cloud (Research Cloud)



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