NL Data Intensive Astronomy Centres workshop 12 March 2024

Session 2: Processing & Pipelines Challenges

Outline

- OmegaCEN Astronomical Science Data Center
- {data model + database}-centric processing & pipelines challenges
- Euclid experience and lessons learned

OmegaCEN

Astronomical Science Data Center

Gijs Verdoes Kleijn

Rees Williams

Willem-Jan Vriend

university of groningen

CIT & Kapteyn

Sterrewacht Leiden

NOVA

ESO

esa European Space Agency

ATG europe accelerating innovation

240312

Opt/IR Astro Information Systems
survey production, quality control, analysis

Opt/IR survey astro-science

OmegaCEN

Societal astronomy

Data Science Systems Education

Astronomical data-intensive science through information systems aligned with NL Opt-IR instrumentation

societal / non-astro project portfolio

DSSC Data Science & Systems Complexity

TarGet

TarGet Field Lab

AstroWISE

FOTOS OPS

Space Situational Awareness Platform

sky darkness, fireballs satellites, asteroids

information Systems

AstroWISE → MuseWISE → EuclidDPS → ELT Science Platform

OmegaCEN → Euclid Science Data Center → Astro SDC

ESO Data Processing System

Euclid Science Platform

2000 2005 2010 2015 2020 2025 2030

NL instrumentation & data

VST

VL

Euclid

EL

OmegaCAM

KiDS

MUSE

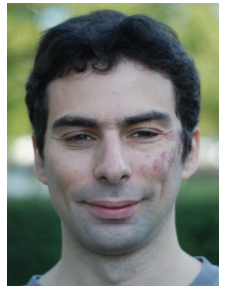
Euclid

FOTOS OPS

METIS MICADO

Kapteyn + CIT OmegaCEN & partners (Leiden Obs, ATG)

Gijs
Verdoes Kleijn
PhD, astro



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pipelines

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pipelines

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Prof

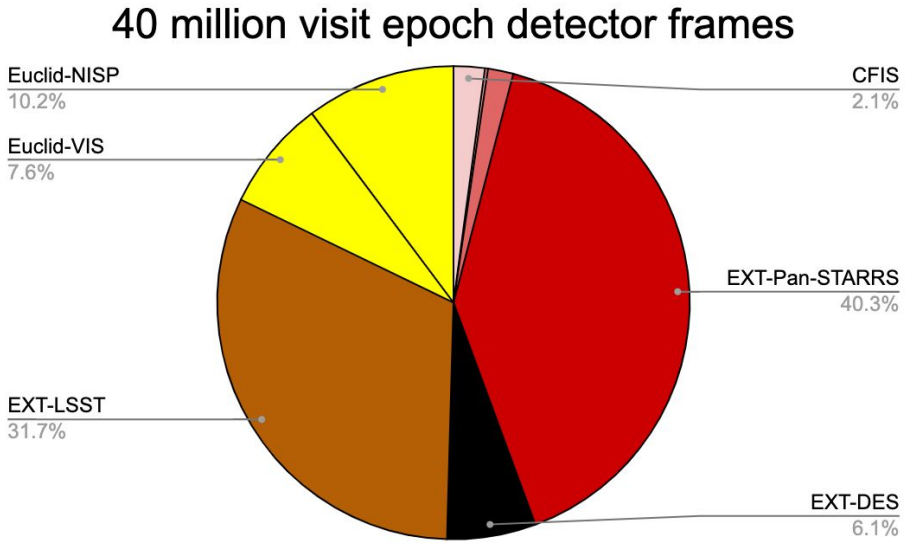
Euclid Science Platform

Space Situational Awareness Platform

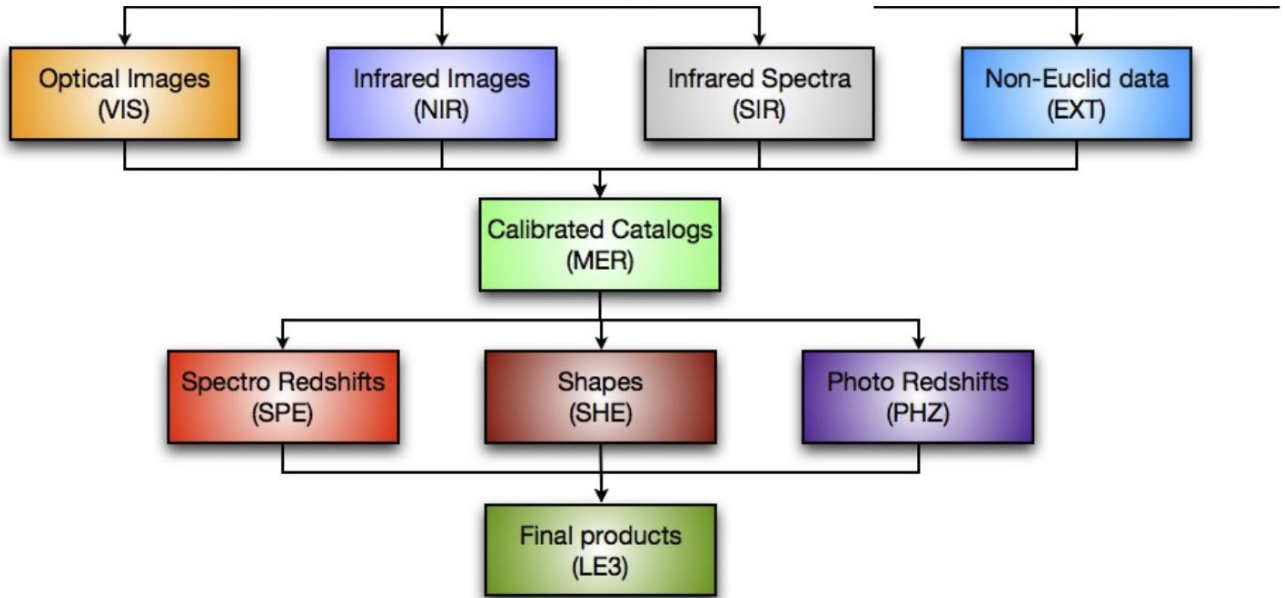
ELT Science Platform

Euclid experiment: 6 instruments and 10 data & processing centers spread over Earth and L2:

space

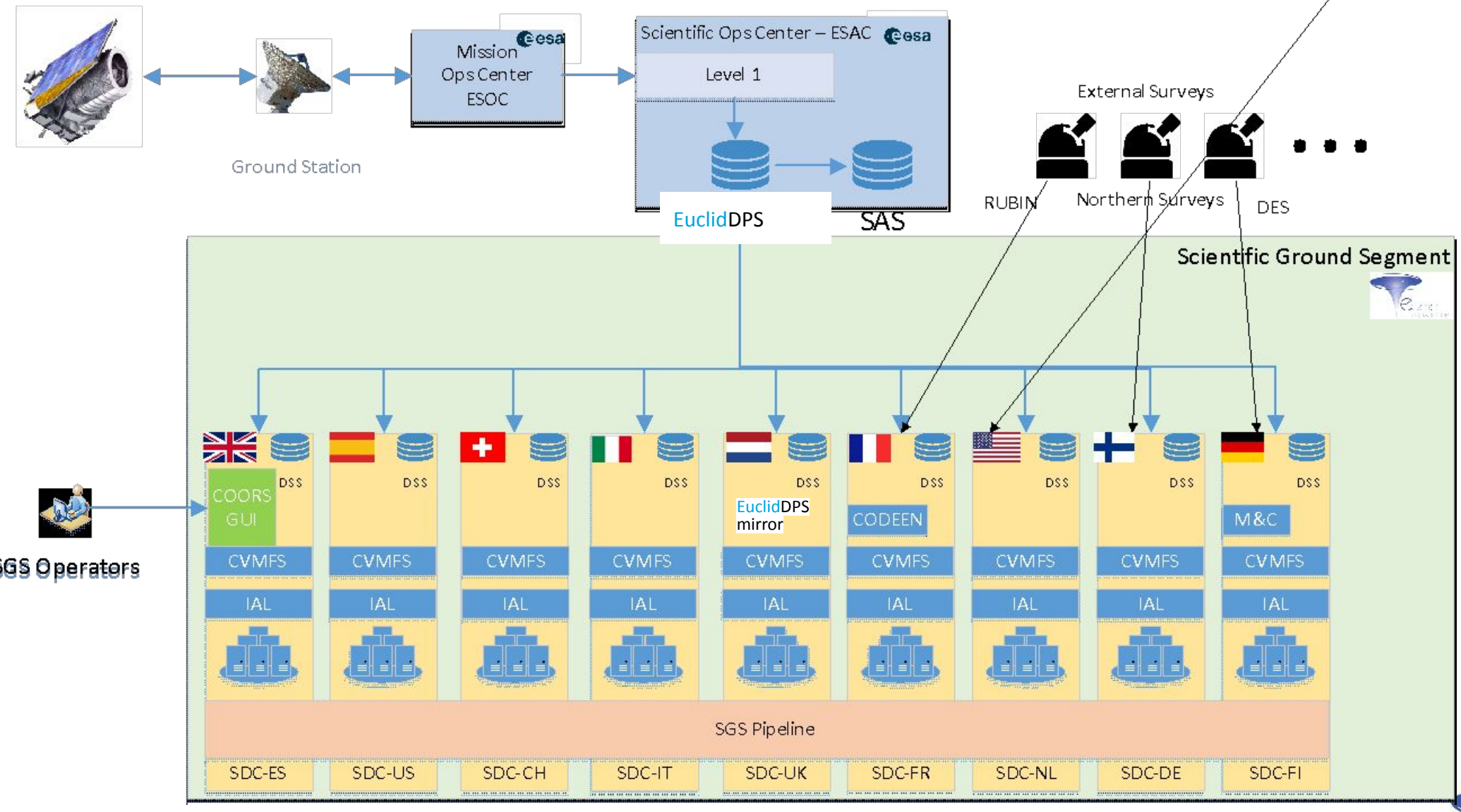


Pipelines (up to few dozen in each box):



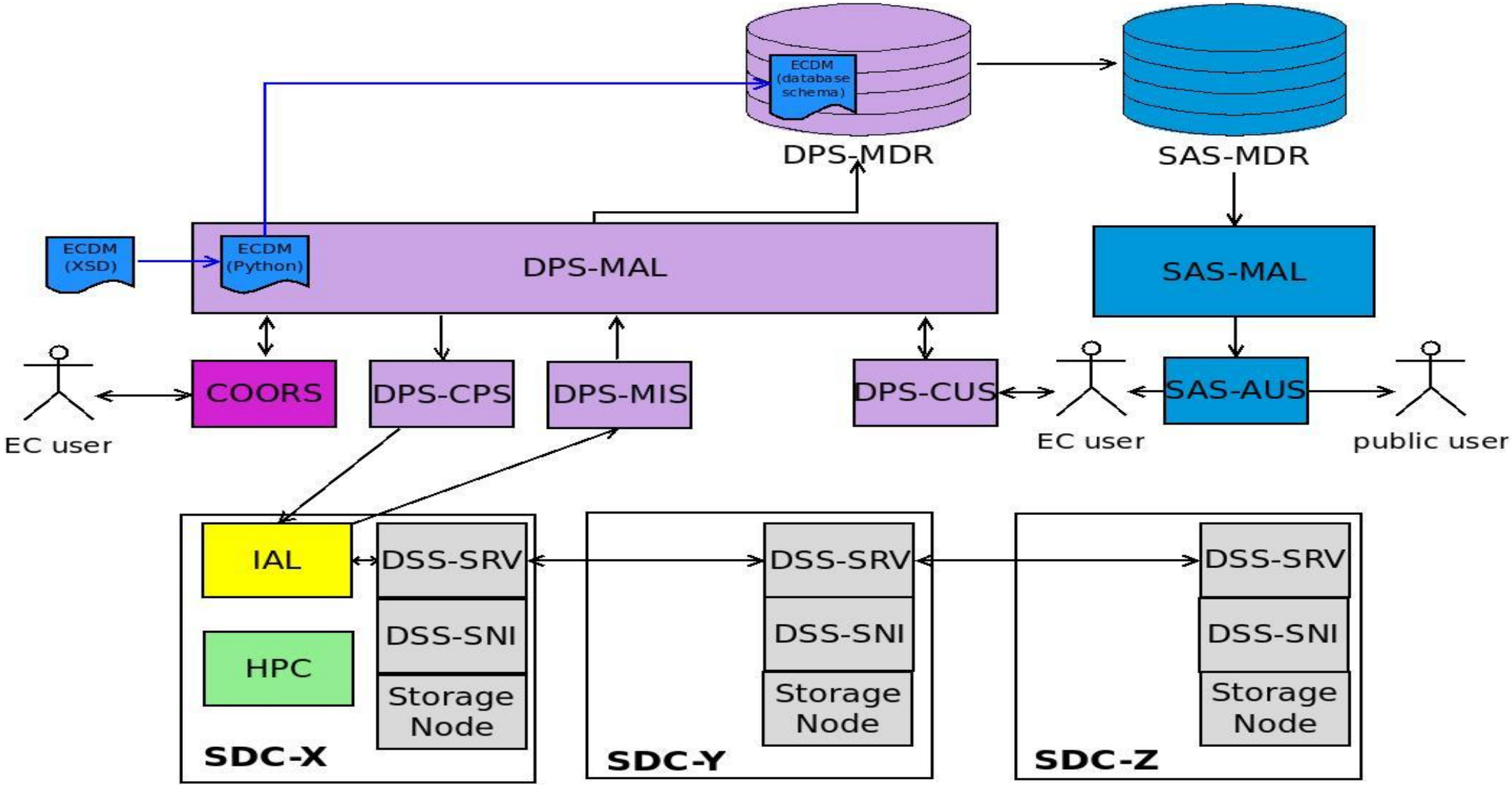
raw: order 3 Pbyte
total: order 30 Pbyte
information system users: order 2500

Euclid Science Ground Segment architecture overview



Euclid Science Ground Segment

Euclid Consortium



Organizing distributed communities – Open Science

for survey production for science analysis

Cathedral

Database

Data model

Access layers

DPS MAL

DPS x

IAL

DSS x

Containers -data Meta data

Bazar

Hardware

processors

storage

Jupyter-based Science Platform

Slide courtesy: Edwin Valentijn

Main lessons learned Euclid

Choice: database-centric: all data items specified via an XML Schema Definition: XSD Data Model

+ acts as software-readable interface control document: automates creation database schema and database interfaces
- development of human readable version was under-prioritized: readability perceived as challenging for humans. Even for some pipeline developers.
- relationship between data items was not captured: hampers automated orchestration workflow: becomes human intensive

Choice: pipelines do not interface with database: input data items specified by separate process

+ immune to Data Processing Center rules about interfaces to databases external to Data Processing Center

- metadata via XML is major overhead on system.

Choice: full freedom on types of data storage and types of compute in data processing centers

+ cheap in terms of infra-hardware & its personpower: maximizes resident expertise and

- expensive in terms of infra-software & its personspower: need to debug up to 10 times as many infrastructures. (Just posix compliancy would already have helped)

END