1st DestinE User eXchange 2023

15th February 2023 | ESA-ESRIN | Frascati (Rm), Italy

The Digital Twin Engine

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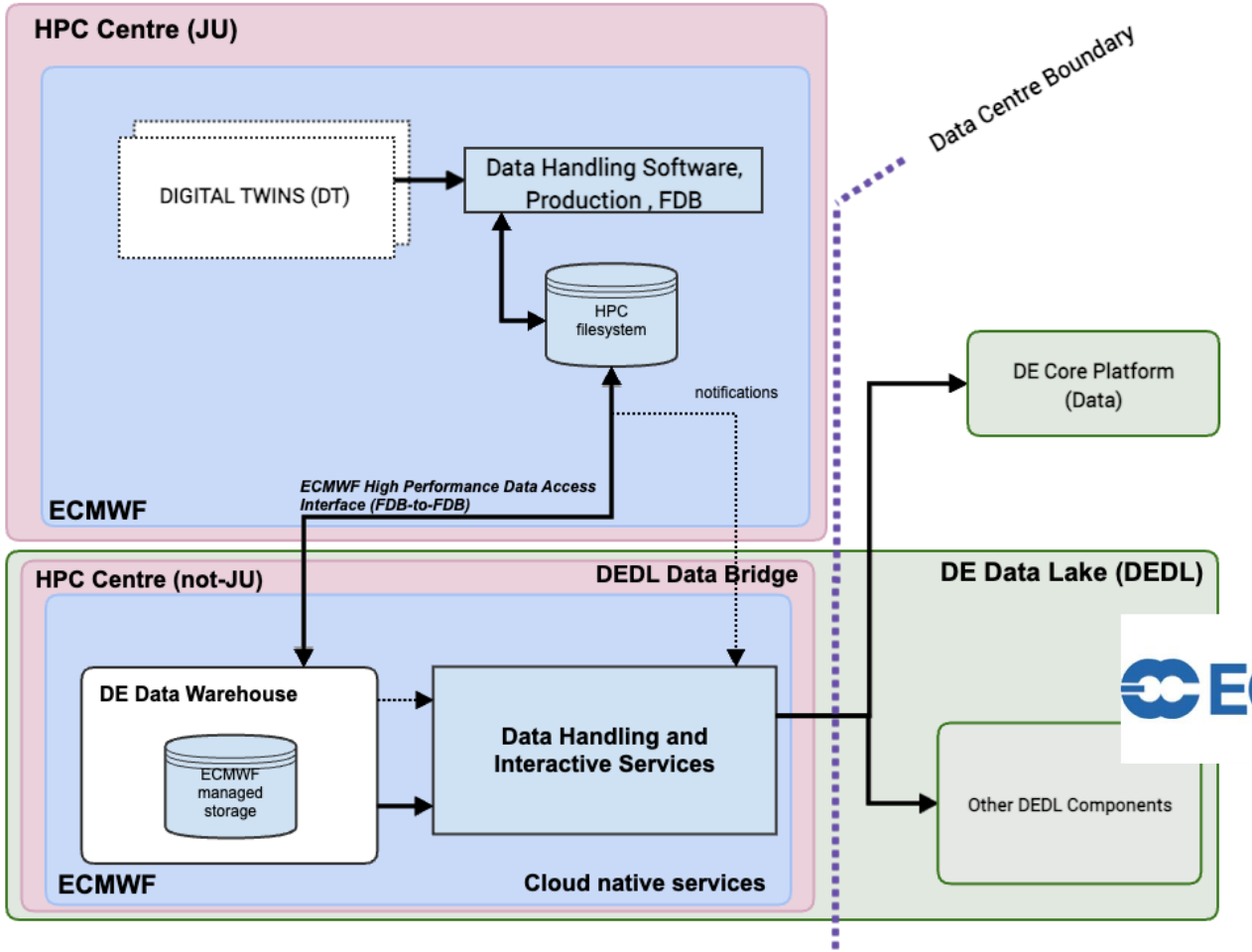
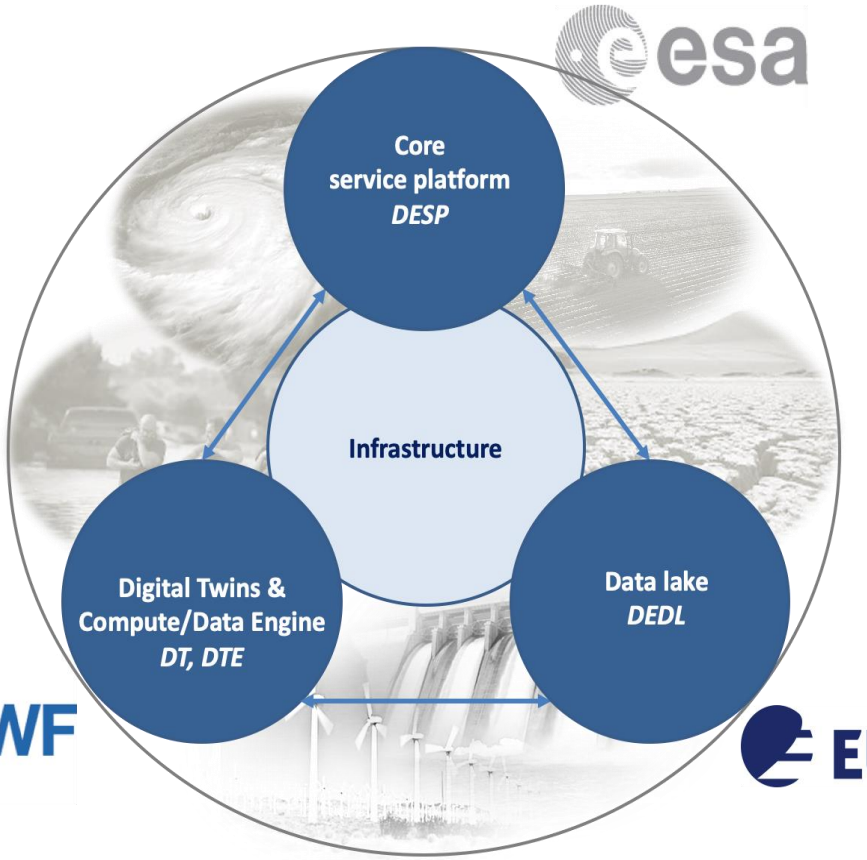
ECMWF

DTE in the Destine system





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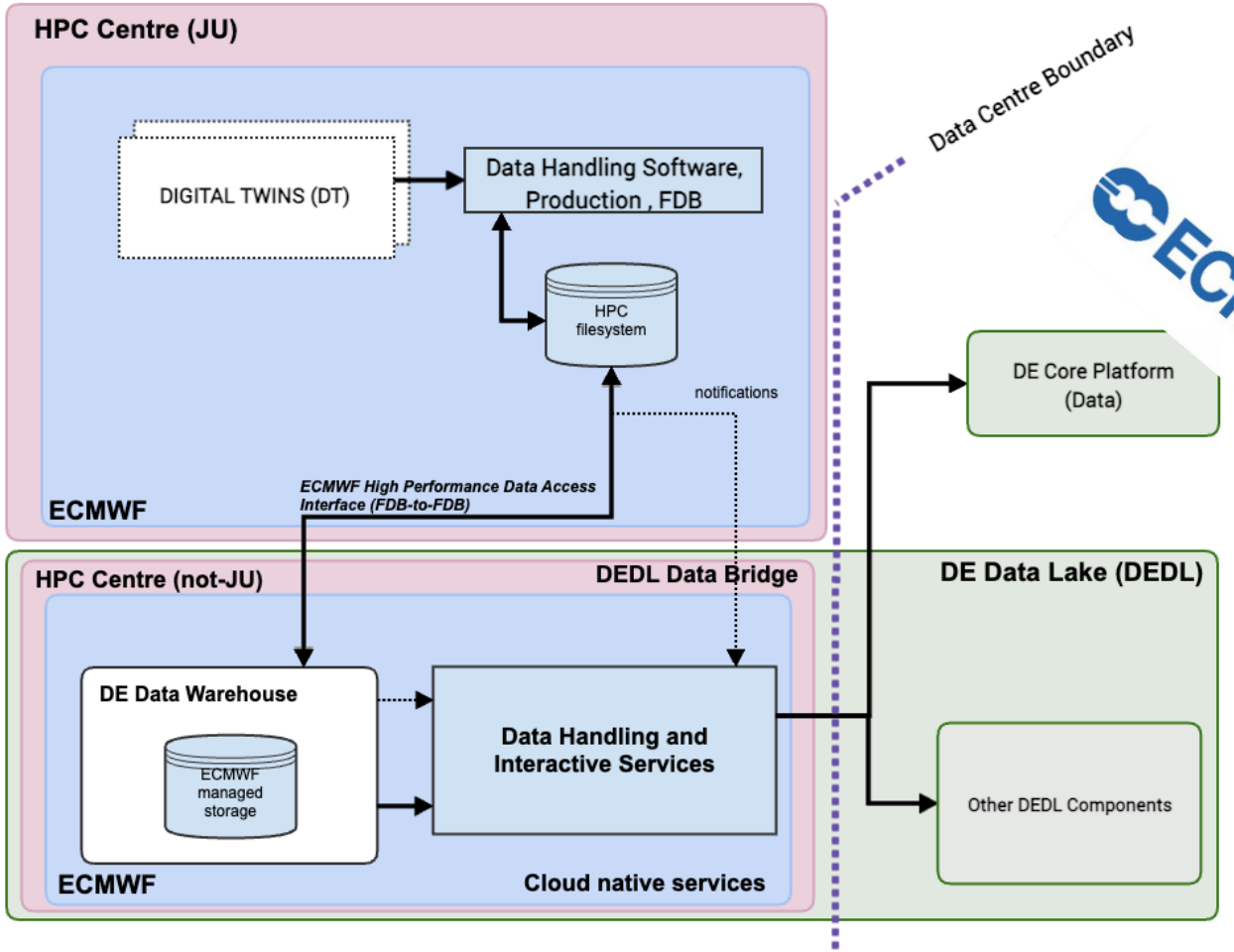
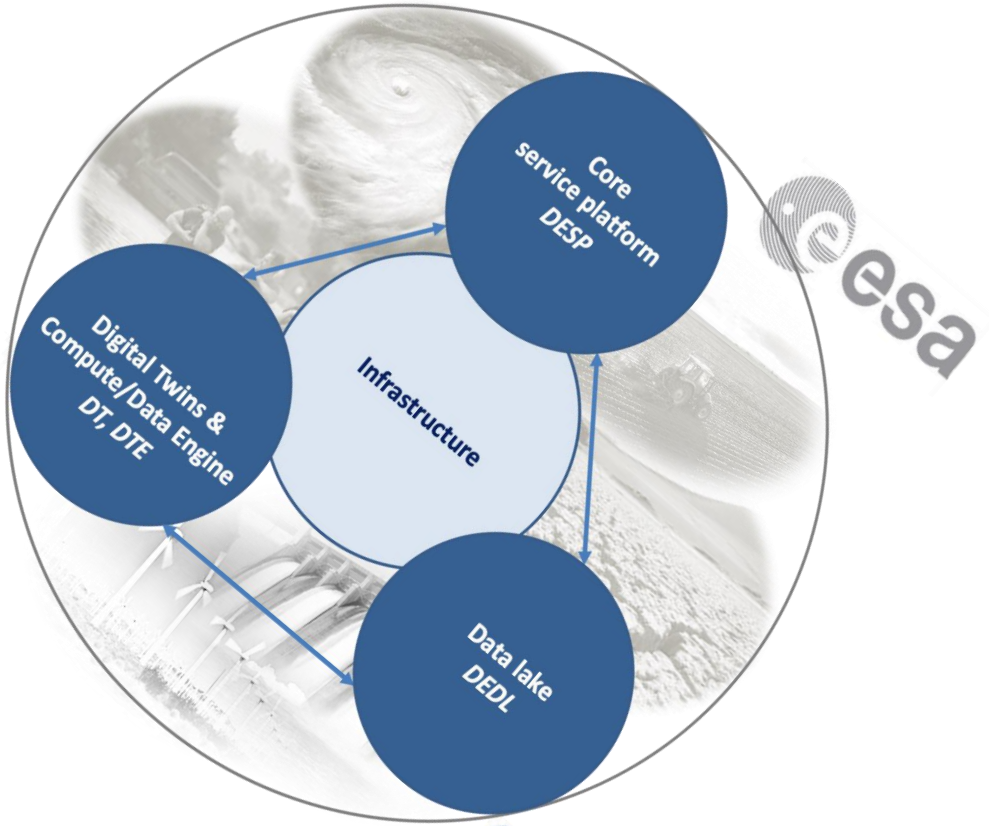
EUMETSAT

DTE in the Destine system





DTE interfaces

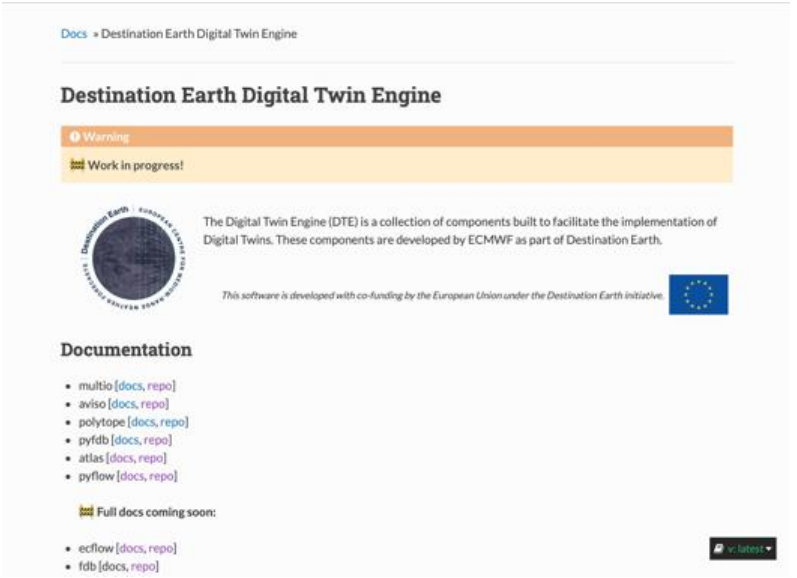
1. **Better simulations** based on **more realistic models**
2. **Better ways of combining all observed and simulated information** from entire Earth system = physical + food/water/energy/health **supporting action scenarios**

3. Interactive and configurable access to all data, models and workflows

Framework for **Earth System Model** Workflows

Think of a Game Engine but for Earth Systems…

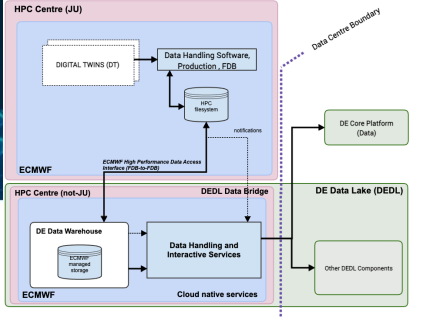
- It's a Framework – not model specific
- Collection of API's and Services
- Opt-in Components



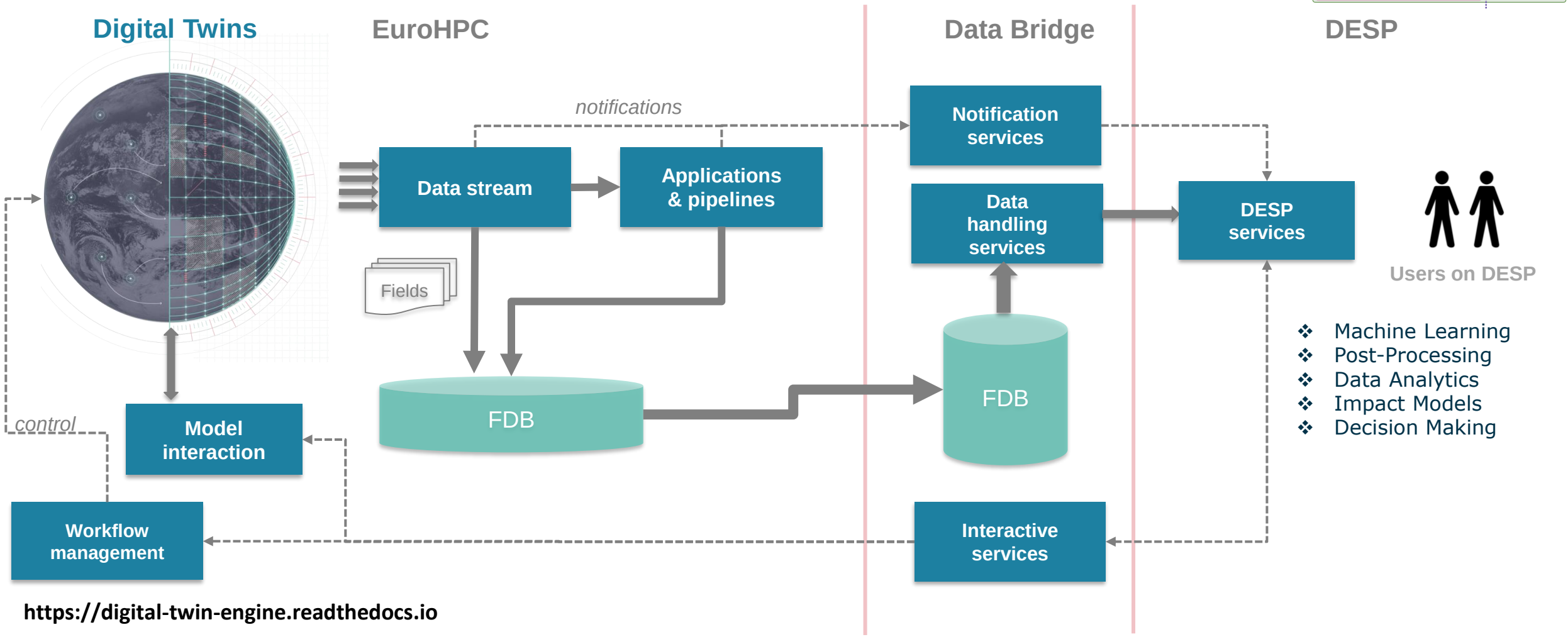
Documentation available @ https://digital-twin-engine.readthedocs.io

ECMWF

Funded by the European Union



DTE components and objectives



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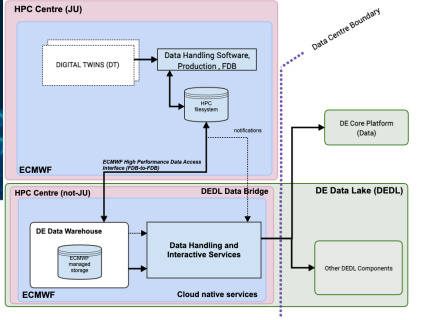

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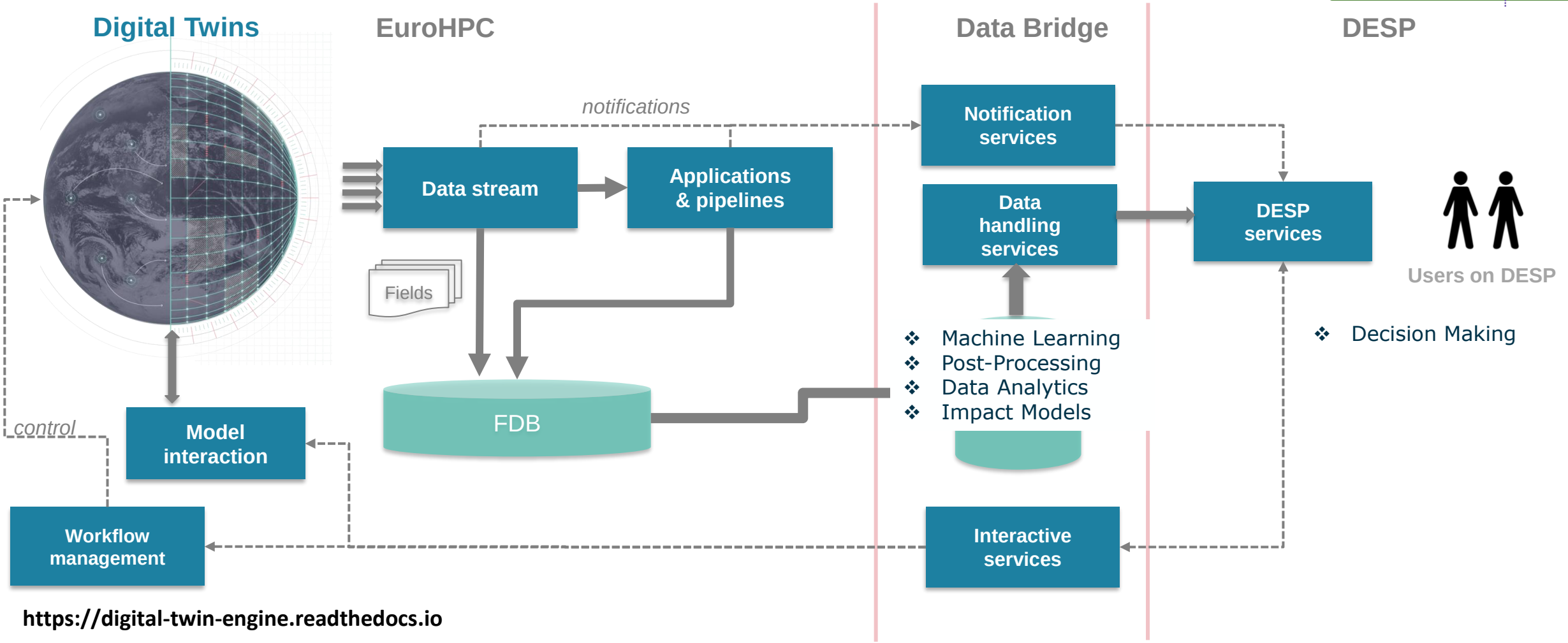

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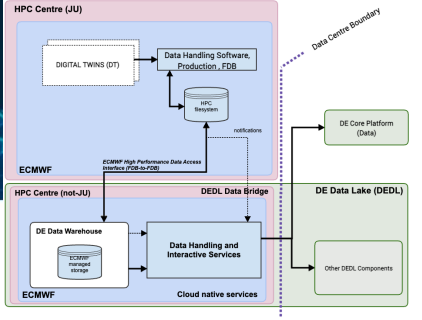

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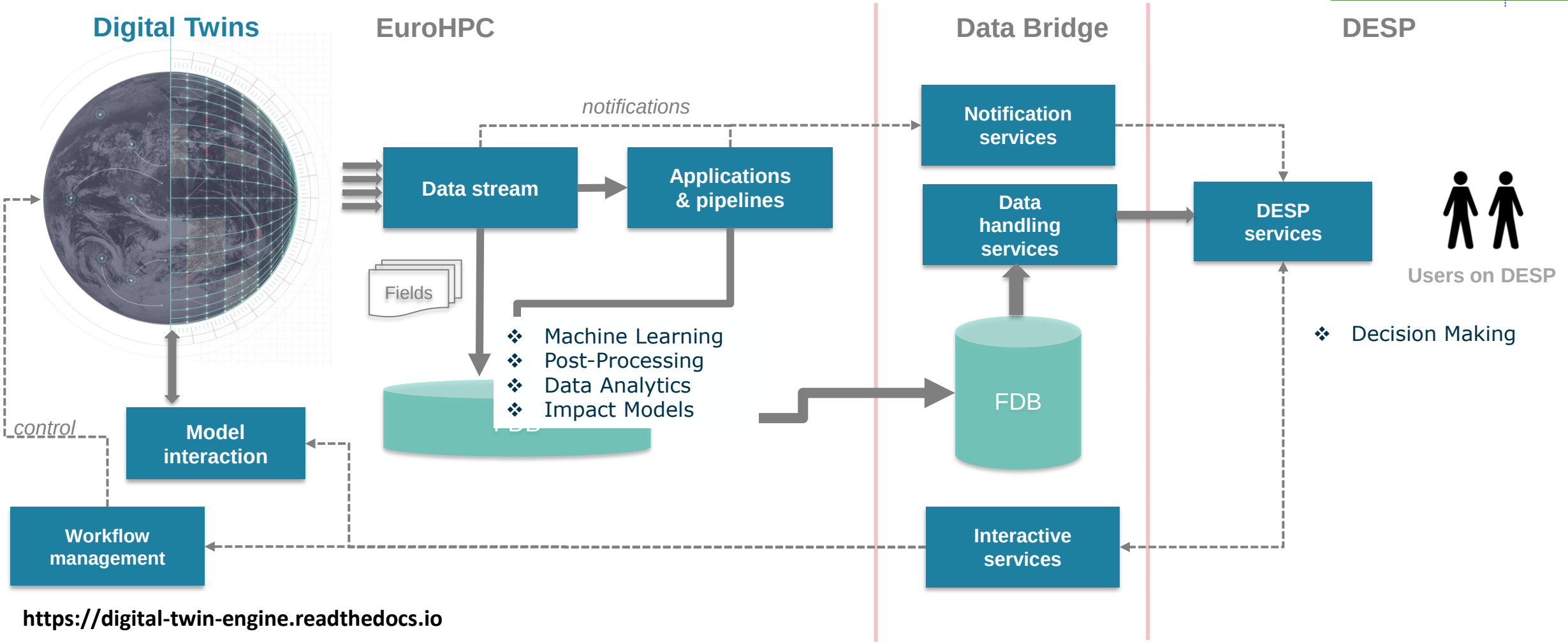

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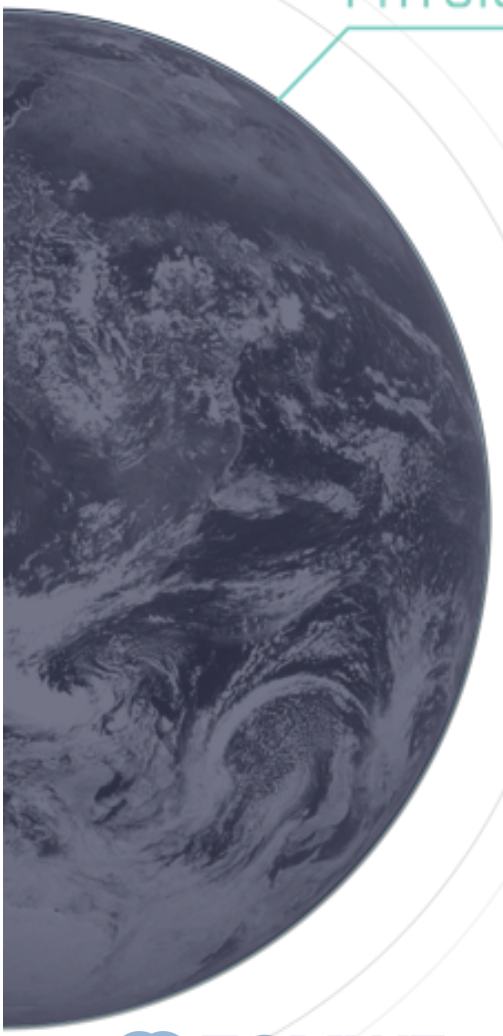
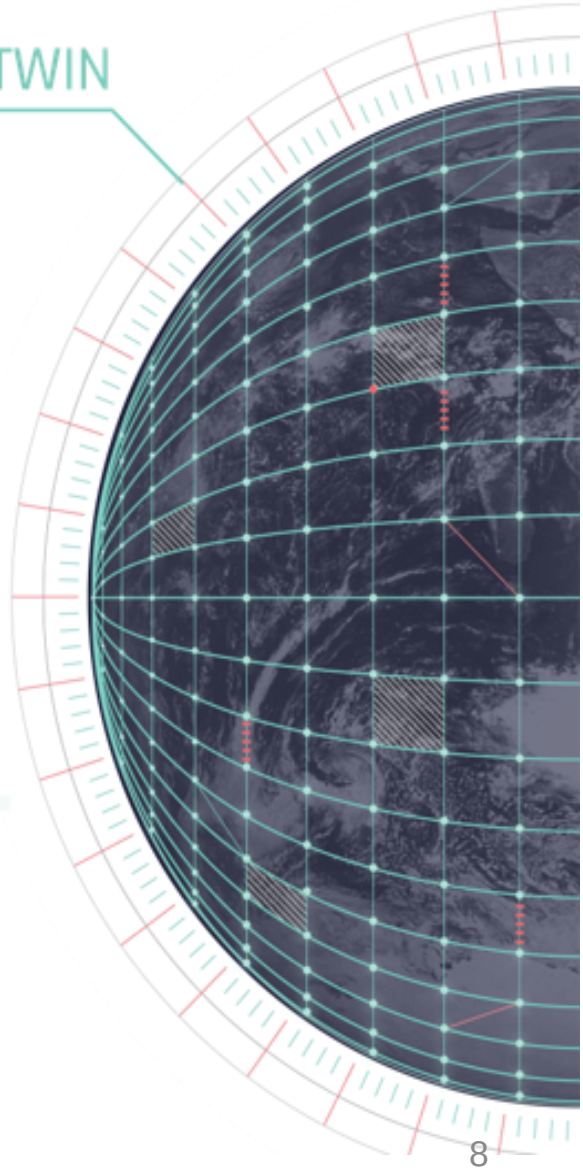
THE THREE WORKFLOWS

PHYSICAL WORLD



DIGITAL TWIN



Workflow 1: rapid research prototyping

"I want to check that my code compiles and the model runs and produces sensible results on a specific case."

Workflow 2: full research experimentation

"I want to be able to easily run the model on a variety of dates or data sources, post-process results, perform scientific analysis, and archive the results for later."

Workflow 3: prototype operational production

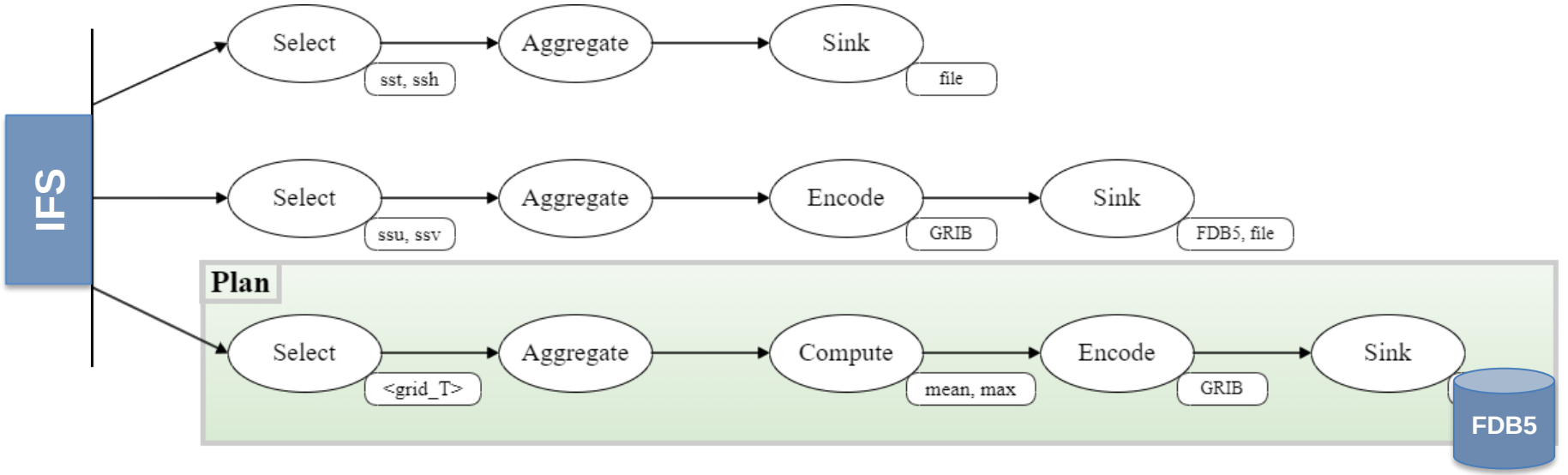
"I want to generate model forecasts into the future of a fixed configuration on a real-time, reliable schedule."

Minimal Viable Product

Minimum implementation to support end-to-end use cases:

- Product generation according to user requirements
  - Data pushed to S3 bucket
  - User notified of availability by Aviso
- Automated plotting of generated forecast data
  - Data retrieved from S3 after Aviso notification
  - Plotted using Skinny WMS
- Retrieve data via Polytope on-demand (integration with Jupyter Notebook)
- Retrieve data via Polytope after notification from Aviso subscription

Pipelines and Actions



Developed in December and January

- Pipeline routing with select action
- GRIB encoding in post-processing pipelines *(simple prototype)*
- Action supporting interpolation and regridding
- Accumulation and statistics

EuroHPC & Data Bridge Anticipated Timelines 2023

- **Q1** Deployment and testing on LUMI & Ancillary Cloud system
- **By Q2** Access to Data Bridge hardware
- **End Q2** Minimal Viable Product and demonstrators
  - A working, end-to-end data flow to support models
- **Q3-Q4** Development of more full-featured components
  - Adaptations to higher resolution
  - IO Server support
  - More flexible data handling and processing