From Toolbox to Services

Cloudification of the Sen4CAP and Sen4Stat Processors

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Sen4CAP

- Sen4CAP aims to provide users with validated algorithms, products and workflows for the European CAP monitoring
- Used by multiple paying agencies in Europe
- Based on the same platform as Sen2-Agri and Sen4Stat
- Open source software anyone can download and install

Sen4CAP Products

Pre-processed optical and radar products

- Sentinel-2 atmospherically corrected (L2A) products
- Sentinel-1 backscatter & coherence products

Sen4CAP Products

Biophysical vegetation status indicators

- Normalized Difference Vegetation Index (NDVI)
- Normalized Difference Water Index (NDWI)
- Leaf Area Index (LAI)
- Fraction-Absorbed Photosynthetically Active Radiation (fAPAR)
- Fraction of Vegetation Cover (FCover)

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Computed per-pixel, then aggregated over parcels

Sen4CAP Products

Cultivated crop type map

- Multi-temporal classification
- Can use optical or radar data, at choice

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Vector product, at parcel level

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- Identification of crop harvesting / clearance
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Sen4CAP Components

- Product acquisition
- Orchestration and scheduling
- Processing
- Visualisation and data access

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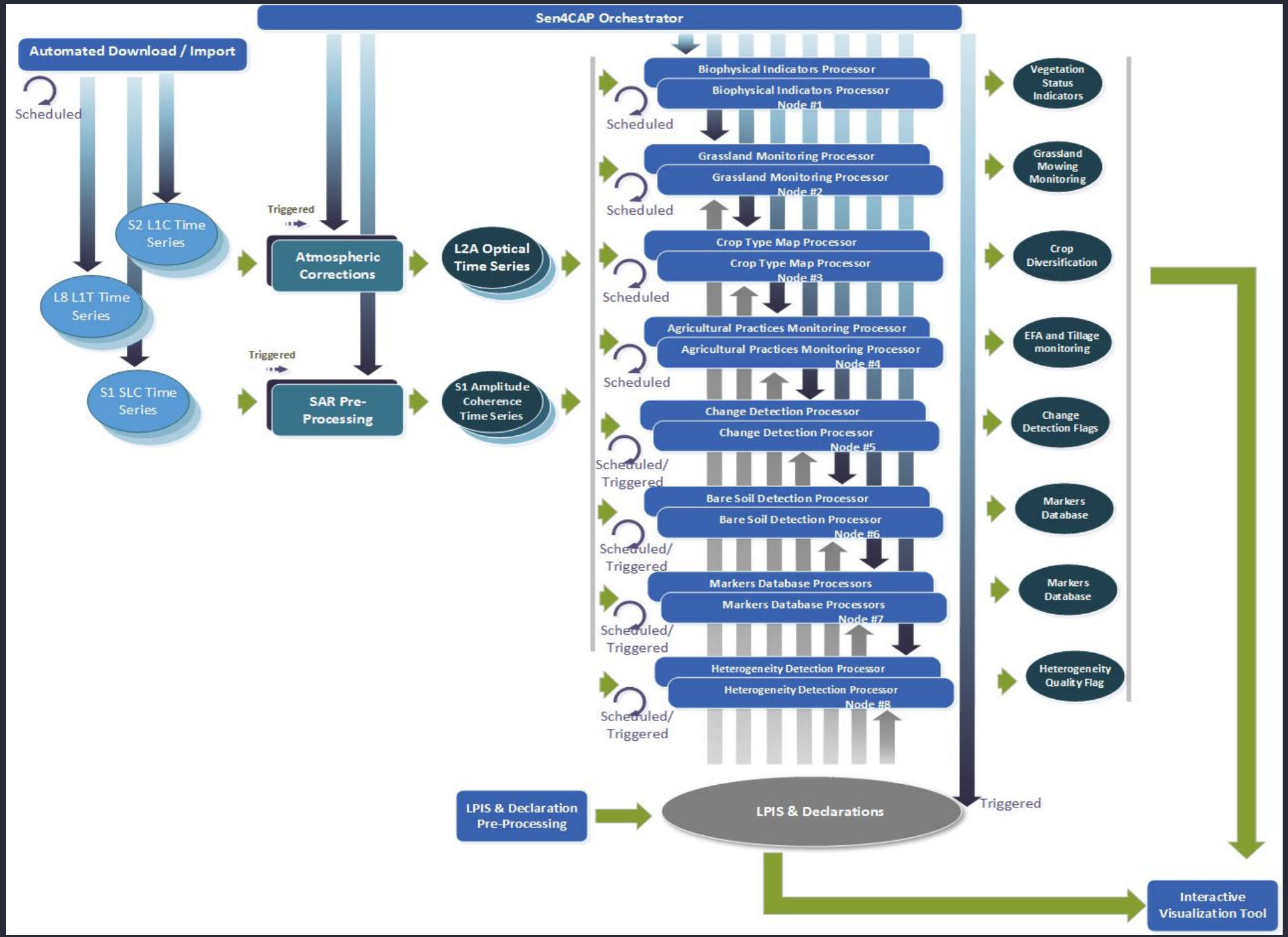
"All-in-one" package, can be installed locally or on the cloud

Sen4CAP Components


Sen4CAP Orchestrator
Automated Download / Import
Scheduled
S2 L1C Time Series
L8 L1T Time Series
S1 SLC Time Series
Triggered
Atmospheric Corrections
Triggered
SAR Pre-Processing
L2A Optical Time Series
S1 Amplitude Coherence Time Series
Biophysical Indicators Processor
Biophysical Indicators Processor Node #1
Scheduled
Grassland Monitoring Processor
Grassland Monitoring Processor Node #2
Scheduled
Crop Type Map Processor
Crop Type Map Processor Node #3
Scheduled
Agricultural Practices Monitoring Processor
Agricultural Practices Monitoring Processor Node #4
Scheduled
Change Detection Processor
Change Detection Processor Node #5
Scheduled/ Triggered
Bare Soil Detection Processor
Bare Soil Detection Processor Node #6
Scheduled/ Triggered
Markers Database Processors
Markers Database Processors Node #7
Scheduled/ Triggered
Heterogeneity Detection Processor
Heterogeneity Detection Processor Node #8
Scheduled/ Triggered
Vegetation Status Indicators
Grassland Mowing Monitoring
Crop Diversification
EFA and Tillage monitoring
Change Detection Flags
Markers Database
Markers Database
Heterogeneity Quality Flag
LPIS & Declaration Pre-Processing
LPIS & Declarations
Triggered
Interactive Visualization Tool

Why Sen4CAP IaaS?

- Some users don't want to manage a bare-metal server, or even a VM
- Some users prefer to use managed services for accounting and billing reasons
- Managed services are easier to get started with

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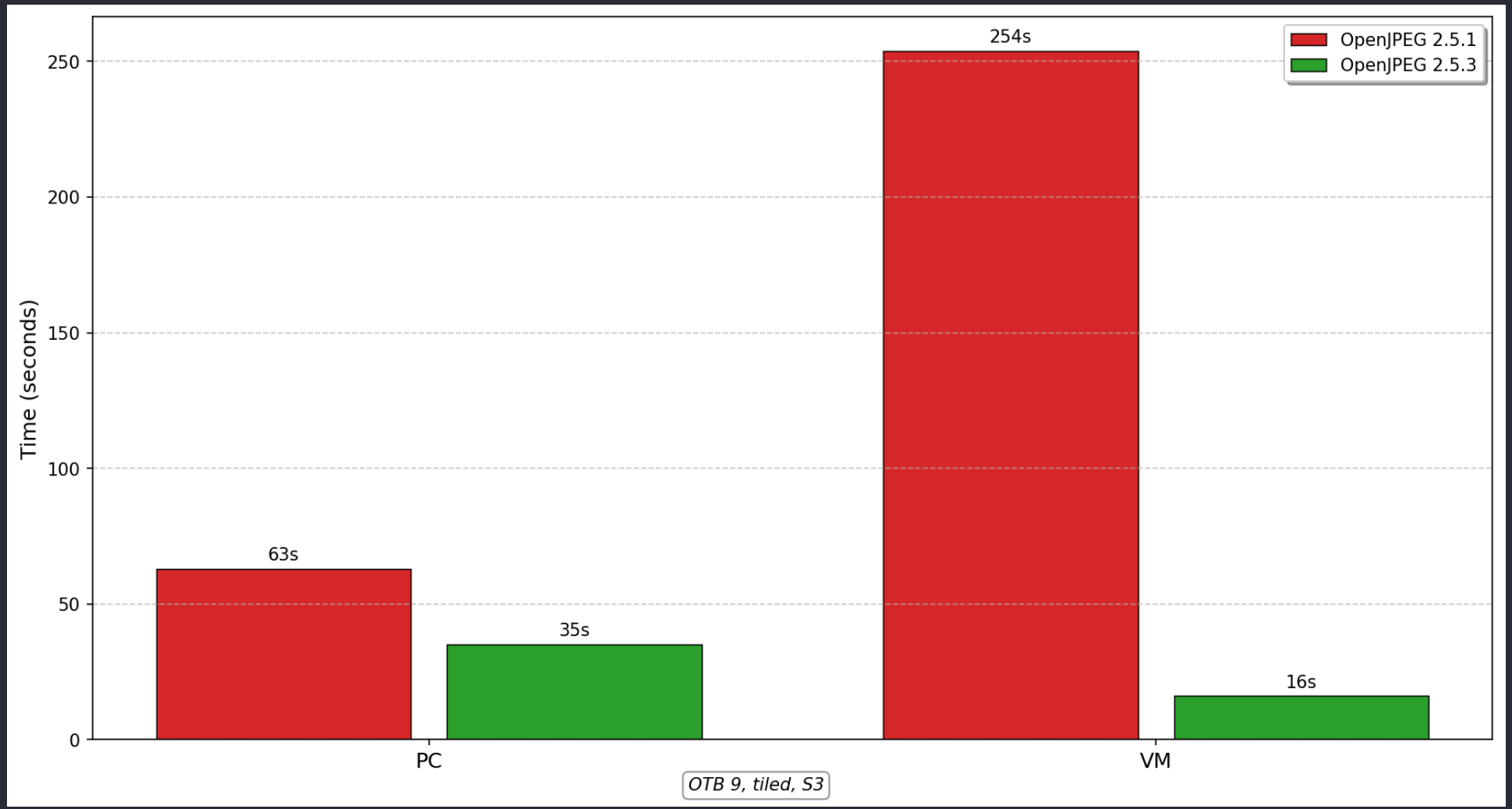
Self-hosting will still be an option

Sen4CAP IaaS – Modernisation

- Upgrading dependencies and base OS image
- Dropping deprecated and unused components
- Slimming down the installation packages and container images
- Optimizations and other adaptations for cloud deployments

OpenJPEG decoding performance



Sen4CAP IaaS – Interoperability

- Exposing the processors over OGC API — Processes
- Common Workflow Language (CWL) support
- Python API, CLI, Jupyter Notebook integration
- SpatioTemporal Asset Catalog (STAC)

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Jupyter Demo

Sen4CAP IaaS – Scientific enhancements

- Winter cover crop detection
- Bare soil detection and monitoring
- Tillage detection improvements

Sen4CAP IaaS – Scaling down

- Sen4CAP mainly runs on Sentinel-2 tiles
- Overall, we're not completely unhappy with the system performance
- Users generally prefer a single output mosaic
- Try to make this automatic and offer sub-tile processing
- Not possible in every processor (e.g. crop type)

Sen4CAP IaaS – Managed services

- Integration with ESA's APEx platform
- OGC EO Application Packaging Best Practices compatibility
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Sen4CAP on APEx

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- Use predefined data sources and container images, or bring your own
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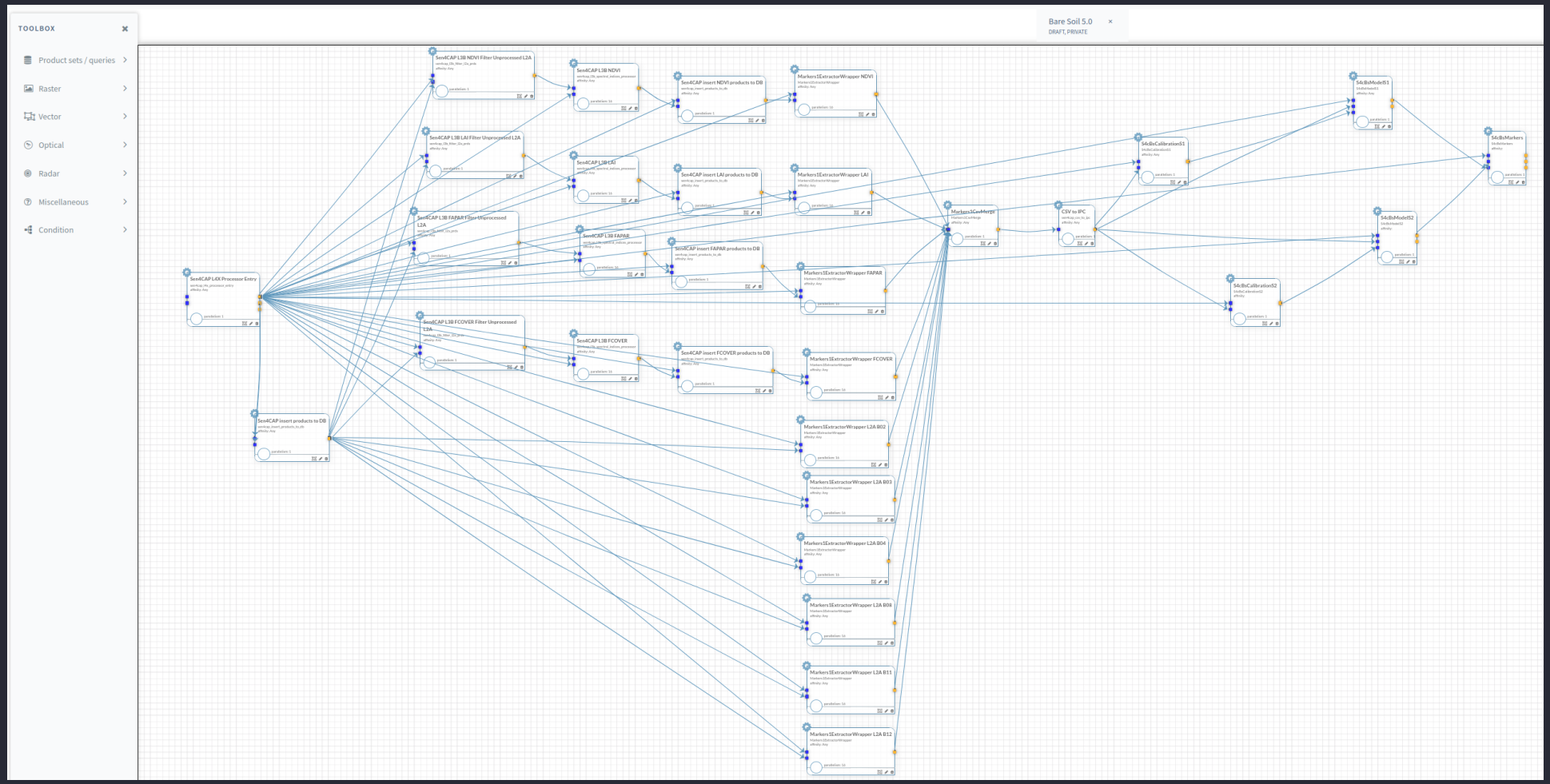
TOOLBOX
Product sets / queries
Raster
Vector
Optical
Radar
Miscellaneous
Condition
Bare Soil 5.0
DRAFT, PRIVATE
Sen4CAP L4X Processor Entry
Sen4CAP insert products to DB
Sen4CAP L3B NDVI Filter Unprocessed L2A
Sen4CAP L3B NDVI
Sen4CAP insert NDVI products to DB
Markers1ExtractorWrapper NDVI
Sen4CAP L3B LAI Filter Unprocessed L2A
Sen4CAP L3B LAI
Sen4CAP insert LAI products to DB
Markers1ExtractorWrapper LAI
Sen4CAP L3B FAPAR Filter Unprocessed L2A
Sen4CAP L3B FAPAR
Sen4CAP insert FAPAR products to DB
Markers1ExtractorWrapper FAPAR
Sen4CAP L3B FCOVER Filter Unprocessed L2A
Sen4CAP L3B FCOVER
Sen4CAP insert FCOVER products to DB
Markers1ExtractorWrapper FCOVER
Markers1ExtractorWrapper L2A B02
Markers1ExtractorWrapper L2A B03
Markers1ExtractorWrapper L2A B04
Markers1ExtractorWrapper L2A B08
Markers1ExtractorWrapper L2A B11
Markers1ExtractorWrapper L2A B12
Markers1CsvMerger
CSV to IPC
S4cBsCalibration51
S4cBsCalibration52
S4cBsModel51
S4cBsModel52
S4cBsMarkers

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- Currently trying to change that
- Make it easier to accept outside contributions

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Sen4CAP on GitHub

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- Reducing technical debt and improving performance
- Simplifying integration with custom tooling
- Offering managed services
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More on this in the future (hopefully)