ASGARD, a new open-source tool for Sentinel-2 geometric computation

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Context

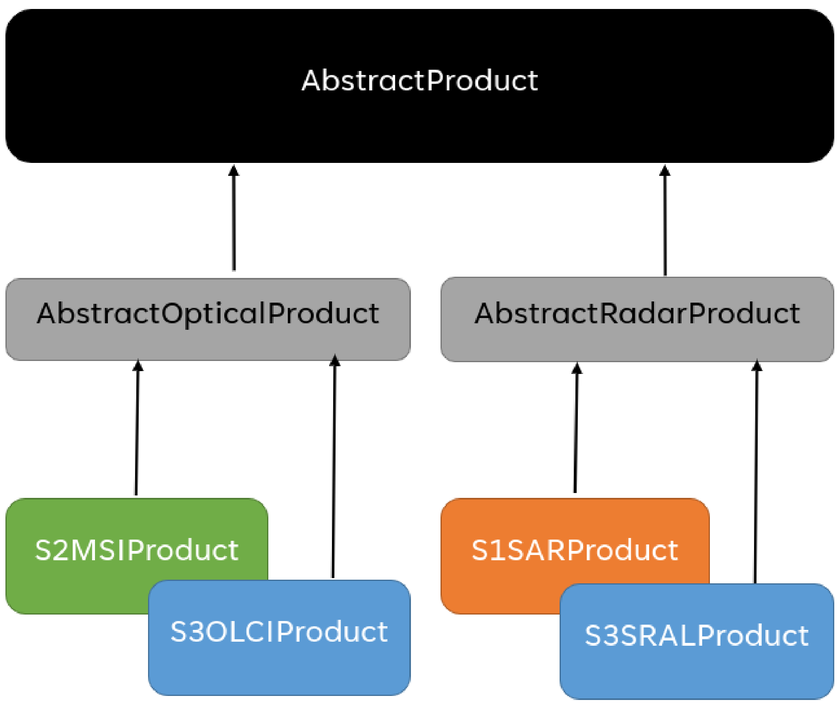
The re-engineering of Sentinel processors requires a common library to perform geometric computation on different kinds of L0/L1 products (optical, SAR, …). To this purpose, a new framework is proposed to supply a modern interface on top of different backends : ASGARD (*A Sensor Geometry Application Reusable by-Design*). Geolocation libraries are useful tools to support geometric quality assessment of Sentinel-2 EO products.

ASGARD : A Sensor Geometry Application Reusable by-Design

- Serve as a base geometry bloc for different types of sensors
- Provide a flexible abstraction layer
- Support the generation of L1/L2 products.
- Compatible with Sentinel missions 1, 2, 3 and beyond

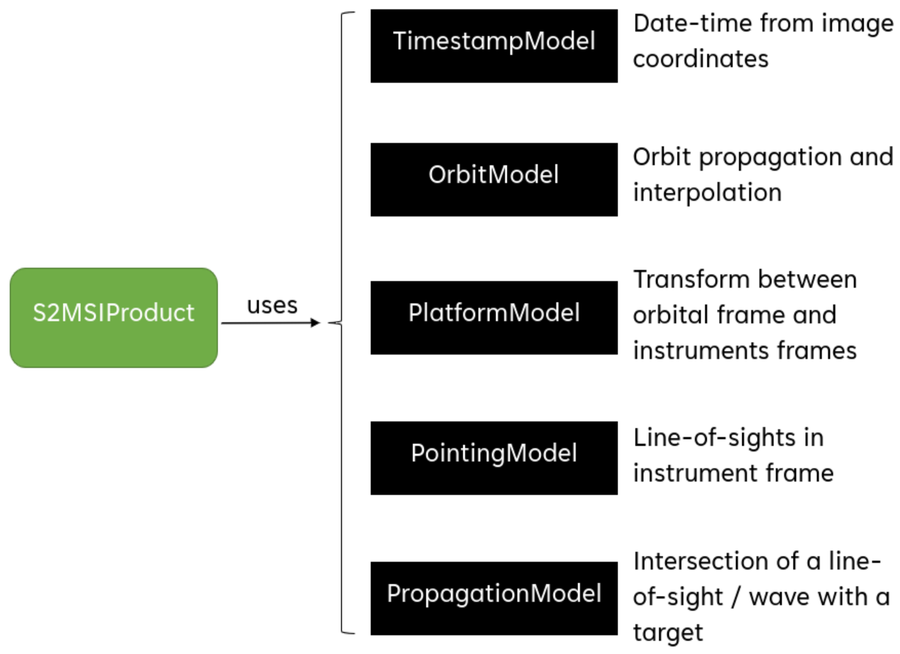
FLEXIBLE	EFFICIENT	COTS	READABLE	REUSABLE
Adapt to different kinds of sensors among the Sentinel series: push-broom, SAR, sounder, ...	Processing on single values as well as batches	Integrate different backends like rugged/Orekit, EOCFI (legacy)	Use explicit models for each geolocation concept	Abstraction layers Derive existing models & components

Product oriented API (high-level)

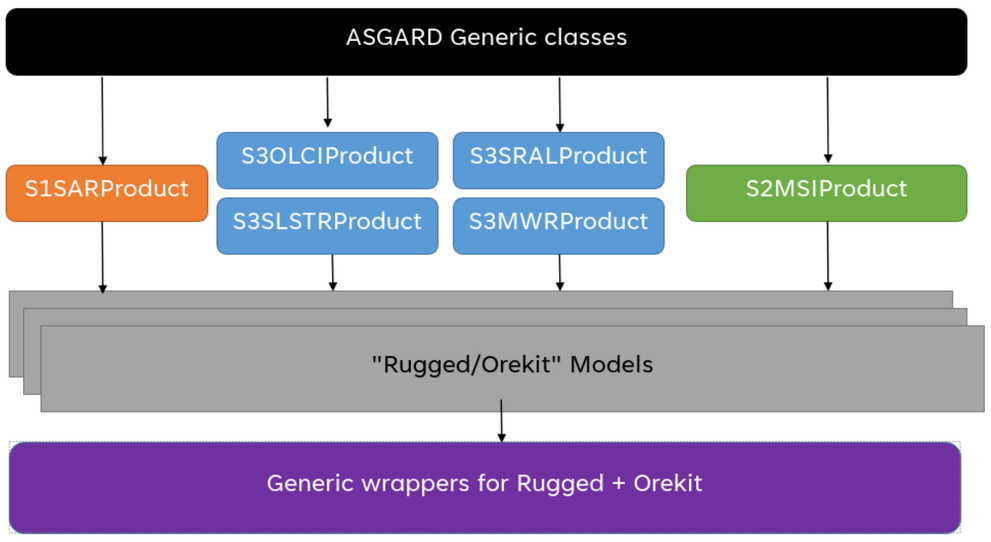


Architecture (low-level)

The low-level API rely on the model abstraction. Each model will implement a part of the “georeferencing pipeline” :



Core modules :

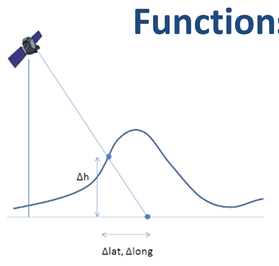


Under the hood Rugged/Orekit is used for the low-level computation. Orekit the space dynamics is used for all what concerns transformations between coordinate systems (inertial/terrestrial) and orbital data but what Rugged [1] brings on top of Orekit, is the capacity to deal with the DEM.

This core has been chosen in continuity of Sentinel-2 geometric solution used in the IPF [2].

Functions :

Examples of high-level functions
- Location : direct/inverse on DEM/ellipsoid/geoid
- Incidences angles
- Sun angles, …



Direct location on DEM

Examples of low-level functions
- Time scale transforms (UTC, TAI, GPS, UT1)
- Frame transforms (ITRF, EME2000,…)
- Celestial bodies ephemerides
- Orbit/attitude handling, …

Usage :

- Development of new processors in the frame of sentinel reengineering (DPR).
- Geolocation libraries are useful tools to support geometric quality assessment of Sentinel-2 EO products.
- Geometry added value layer generation for sentinel2 L1B : direct location grids using SEN2VM (using ASGARD) MPC tool.

[1] https://gitlab.orekit.org/orekit/rugged
[2] L. Maisonobe, J. Seyral, G. Prat, A. Espesset, Rugged: an operational, open-source solution for Sentinel-2 mapping, in SPIE Remote Sensing 2015, Sep 2015