The Generalized Processing Chain for BIRD and FireBIRD Mission

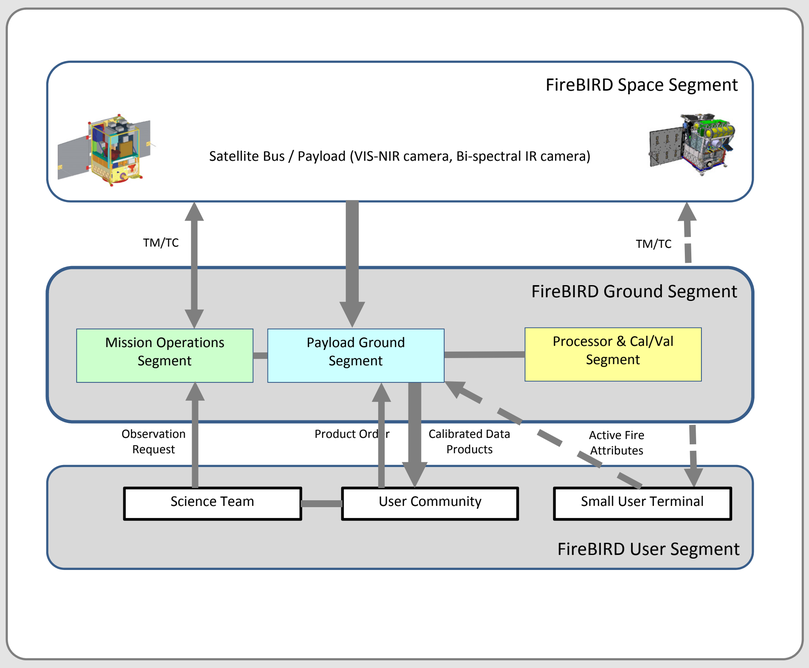
BIRD and FireBIRD Mission Products

The mission FireBIRD is based on a two satellites constellation - OOV-TET-1, launched in July 2012, and BIROS (Berlin Infrared Optical System). This second satellite will be launched in 2014. The satellites are designed to detect and monitor dynamic high temperature events, such as wild fires or volcano eruptions.

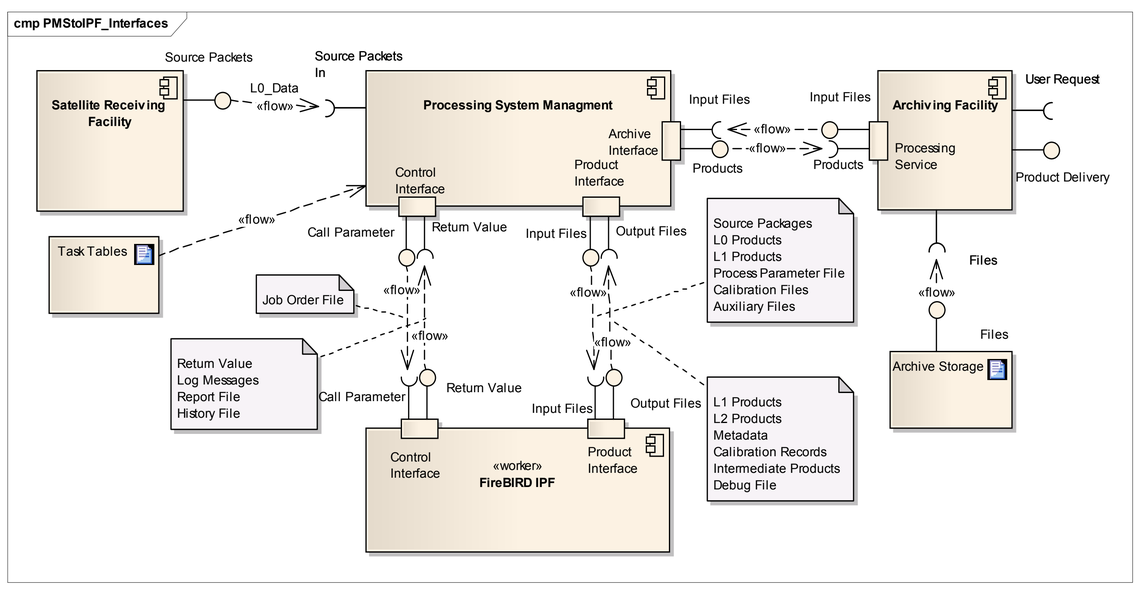
The mission inherits concepts of the small satellite mission BIRD (Bi-Spectral Infra-Red Detection, operational from 2001 to 2006). The heritage relates to the basic design and components of the satellite and will be extended by using a constellation of satellites and takes into account new technical developments. So it is possible to achieve a high reliability, while minimizing the costs.

The ground segment for the mission consists of two main components, the mission operation segment, carried out by German Space Operations Center and the payload ground segment, executed by the German Remote Sensing Data Center with the ground station and the Payload Data Center (PDC) in Neustrelitz. The ground segment is completed by a processor and Cal/Val Segment.

Task of the ground segment is to provide beside multispectral images also quantitative parameters, e. g. temperature maps and energy release in case of forest fires. The archive keeps level 0 products which will be reprocessed to higher level products on demand. The Cal/Val segment monitors the long-term stability of the sensor and provides calibration data sets for the data processor.



Components and data flow in the ground segment



Ground Data Processing Facility Interfaces

The Generic Processor

In the past typically all, ground segment facilities and services incl. its processors were a specific development to a mission. In the last decade a multitude of services was established which work independent from a special mission. DLRs Data and Information Management System (DIMS) is such an example. In the last years this services were complemented by two parallel developments. On the one hand generalized work flow management systems were established to combine in an automated or semi-automated way a selection of processors to compute special products from a variety of data sources. DLRs project CATENA is such an example. On the other hand, generalized processors were developed which are able to process a special product from a broad class of input data.

Typically an Instrument Processing Facility (IPF) is a unique solution dedicated to a specific instrument. The reason is that each instrument and mission has its own specific characteristics in terms of data content and physical properties resulting in data structures designed for data downlink. But the effort to adapt a processor to a new mission is very high. The goal should be a processor framework which allows to handle data from different sources and to allow a variety of different processing steps depending on the input data source and output product. This means that the internal data structure needs to be as much as possible separated from instrument specific structures, but still contain s all information needed.

The Abstract Data Model

Data will be stored in objects following an abstract description combining image data and related data, but is still keeping the original image geometry . The image contains the components:

- Meta data (description of image data and sensor)
- Measurement data including quality parameter
- Auxiliary data, e. g. housekeeping data
- Geolocation data
- Processing Records

The data model is oriented on the structure of level 1b products, hence co-referenced images, which are formally independent. Sensor specific parameter are provided in separate subsets of auxiliary data. It is also recommended to use internal naming conventions following a common ontology, thus it is easy to understand the meaning of individual parameter. Also descriptive parameter, such as units are kept along. Measurement data itself represent the pixel value, error margins and confidence parameter.

Along with the data, also functionalities are provided to search, retrieve and write data back to the buffer and provided as an API. This simplifies import and export of data, e. g. the same procedures can be used for writing intermediate or final product data.

Data Flow and Process Control

Processing is controlled from the perspective of the data object, hence a processing operation is called to the data provided. Processing parameter , e. g. whether steps applied successfully or not, is kept within the data buffer and updated with each processing step. Thus makes it possible to adapt successive steps if needed.

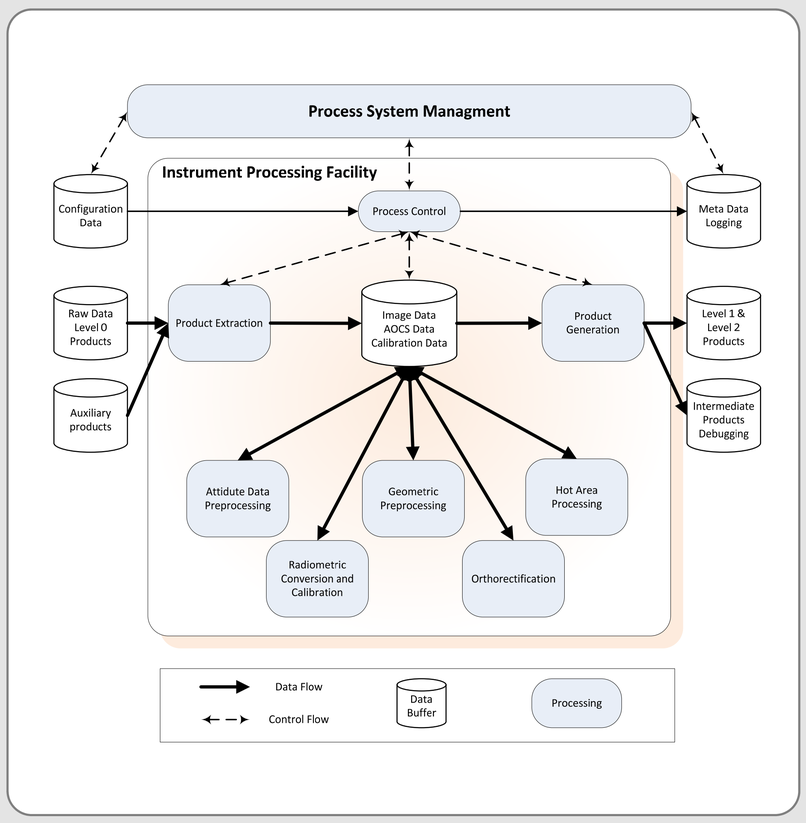
Control interfaces needed for communication with the process environment will be provided in form of libraries.

Conclusions

So far only a prototype version has been successfully implemented, which has shown however the versatility of a data oriented design approach when reacting to algorithmic changes during the commissioning phase.

The proof of concept will be the launch of the BIROS satellite providing new data and reprocessing of BIRD data. The processor will be extended to perform also level 2 processing.

Long term goal is a meta model, aiding modeling and design of new processors or to port an existing software to different platforms.



FireBIRD Image Processor

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