



SDP Functional View

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List of Abbreviations

ADD	Attribute Driven Design
C&C	Component and Connector
FFBD	Functional Flow Block Diagram
PBS	Product Breakdown Structure

1. Primary Representation

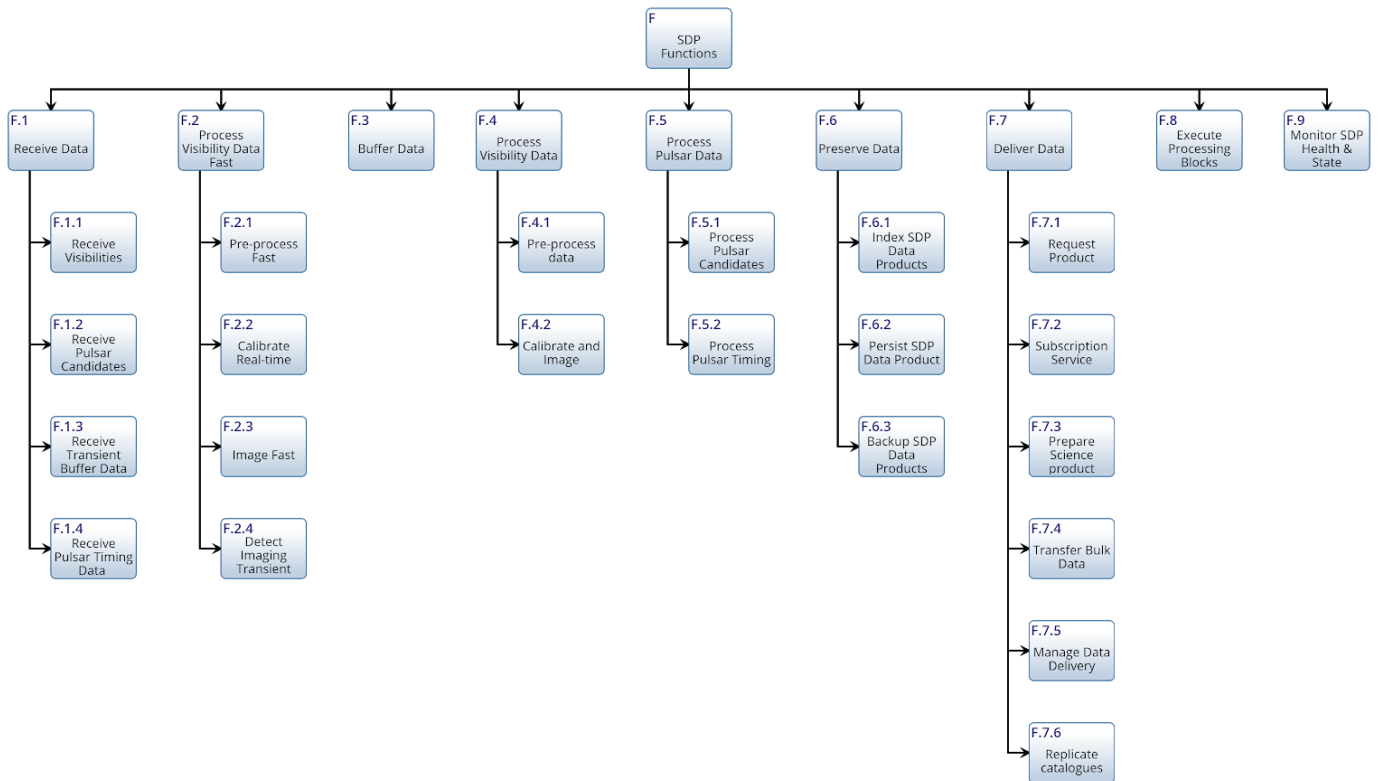


Figure 1: SDP Functional Decomposition representing the primary functionality that is critical to meet the SDP L2 requirements.

SDP functional decomposition is shown in Figure 1. Note this functional decomposition is focussed on primary functionality only in order to complement the SDP Architecture Views. See [section 4](#) for more detail and rationale for Primary Functionality.

The functional decomposition and its relationship to the SDP Product Breakdown Structure (as shown in Table 1) is also used to allocate SDP L2 requirements to functions and products. This is important for requirements that are not architecturally significant since the architecture design and documentation process used for SDP, Attribute Driven Design (ADD) [RD01], is focussed on mainly addressing architecturally significant requirements. Therefore allocation (and traceability) of requirements to functions and/or products allows these requirements to be addressed in the detail design and implementation process.

The allocation of requirements to functions also supports the verification process of functional requirements (as described in [RD03]).

2. Element Catalogue

2.1. Element and Their Properties

Each element shown in the Primary Presentation is a primary function.

2.2. Relations and Their Properties

2.2.1. Relationship to products

Each of these primary functions has a *performed by* relationship to a Product¹. Table 1 below shows this mapping of functions to products following the *performed by* relationship. Products are documented in the SDP PBS [AD1], including Software Modules (see SDP System-level Module Decomposition and Dependency View) and Hardware Products (see Hardware Decomposition View).

¹ This is modelled in Innoslate and functions (actions) are *performed by* products (assets)

SDP Functions to Science Data Processor		Science Data Processor													
		P Science Data Processor	P.1 SDP Software	P.1.1 System Services	P.1.2 Platform Services	P.1.3 Core Processing	P.1.4 Science Pipeline Workflows	P.1.5 Execution frameworks	P.1.6 Execution Control	P.1.7 SDP Services	P.1.8 Data Models	P.1.9 Execution Framework Interface	P.2 SDP Hardware MID/LOW	P.2.1 SDP Compute Hardware	P.2.2 SDP Preservation Hardware
SDP Functions	F SDP Functions	X													
	F.1 Receive Data		X	X	X	X	X	X	X		X		X	X	
	F.1.1 Receive Visibilities		X	X	X	X	X	X	X		X		X	X	
	F.1.2 Receive Pulsar Candidates		X	X	X	X	X	X	X		X		X	X	
	F.1.3 Receive Transient Buffer Data		X	X	X	X	X	X	X		X		X	X	
	F.1.4 Receive Pulsar Timing Data		X	X	X	X	X	X	X		X		X	X	
	F.2 Process Visibility Data Fast		X	X	X	X	X	X	X		X		X	X	
	F.2.1 Pre-process Fast		X	X	X	X	X	X	X		X		X	X	
	F.2.2 Calibrate Real-time		X	X	X	X	X	X	X		X		X	X	
	F.2.3 Image Fast		X	X	X	X	X	X	X		X		X	X	
	F.2.4 Detect Imaging Transient Candidates		X	X	X	X	X	X	X		X		X	X	
	F.3 Buffer Data		X	X	X			X	X	X	X		X	X	
	F.4 Process Visibility Data		X	X	X	X	X	X	X		X		X	X	
	F.4.1 Pre-process data		X	X	X	X	X	X	X		X		X	X	
	F.4.2 Calibrate and Image		X	X	X	X	X	X	X		X		X	X	
	F.5 Process Pulsar Data		X	X	X	X	X	X	X		X		X	X	
	F.5.1 Process Pulsar Candidates		X	X	X	X	X	X	X		X		X	X	
	F.5.2 Process Pulsar Timing		X	X	X	X	X	X	X		X		X	X	
	F.6 Preserve Data		X	X	X					X	X		X	X	X
	F.6.1 Index SDP Data Products		X	X	X					X	X		X	X	
	F.6.2 Persist SDP Data Product		X	X						X			X	X	X
	F.6.3 Backup SDP Data Products		X	X						X			X	X	X
	F.7 Deliver Data		X	X	X				X	X			X	X	
	F.7.1 Request Product		X	X	X					X			X	X	
	F.7.2 Subscription Service		X	X	X					X			X	X	
	F.7.3 Prepare Science product		X	X	X	X			X	X	X		X	X	
	F.7.4 Transfer Bulk Data		X	X	X					X			X	X	
	F.7.5 Manage Data Delivery		X	X	X					X			X	X	
	F.7.6 Replicate catalogues		X	X	X					X			X	X	
	F.8 Execute Processing Blocks		X	X	X				X			X	X	X	
F.9 Monitor SDP Health & State		X	X	X				X			X	X	X		

Table 1: SDP Function to Product mapping where functions are *performed by* products.

As seen in Table 1, the processing functions (F.1 through F.5) map to most of the SDP products shown in the table and therefore the correct interpretation is that most SDP products are required to perform any of the processing functions. Although this is technically the correct way to interpret the *performed by* relationship, and this is typically the mapping used in a functional architecture, it is not a useful view onto the SDP architecture and does not allow for a useful allocation of requirements to products (via functions).

In order to add value to the SDP architecture documentation and to allow for a useful allocation of requirement to products (in particular software modules) the following is proposed as part of the further development of this architecture view:

- Further decomposition of certain primary functions (in particular processing functions) to allow allocation to lower levels of the PBS;
- Use of relationships other than *performed by* to show a mapping of functions to products relevant to a specific area or aspect of the SDP architecture.

2.2.2. Relationship to requirements

The SDP L2 requirements are allocated to the functions shown in Figure 1 and this is documented in [RD02].

2.3. Element Interfaces & Behaviour

From the primary functions defined in section [1. Primary Representation](#), further functions are implied by the context, external data flow and chosen architecture. The action diagrams in Figure 2 - Figure 8, show the behaviour of the primary functions within the SDP context. The focus of this view remains the primary functions. Interactions and behaviours shown here are merely intended to create context for the primary functions. The SDP Architectural C&C Views developed the implied functionality with its behaviour and data flow.

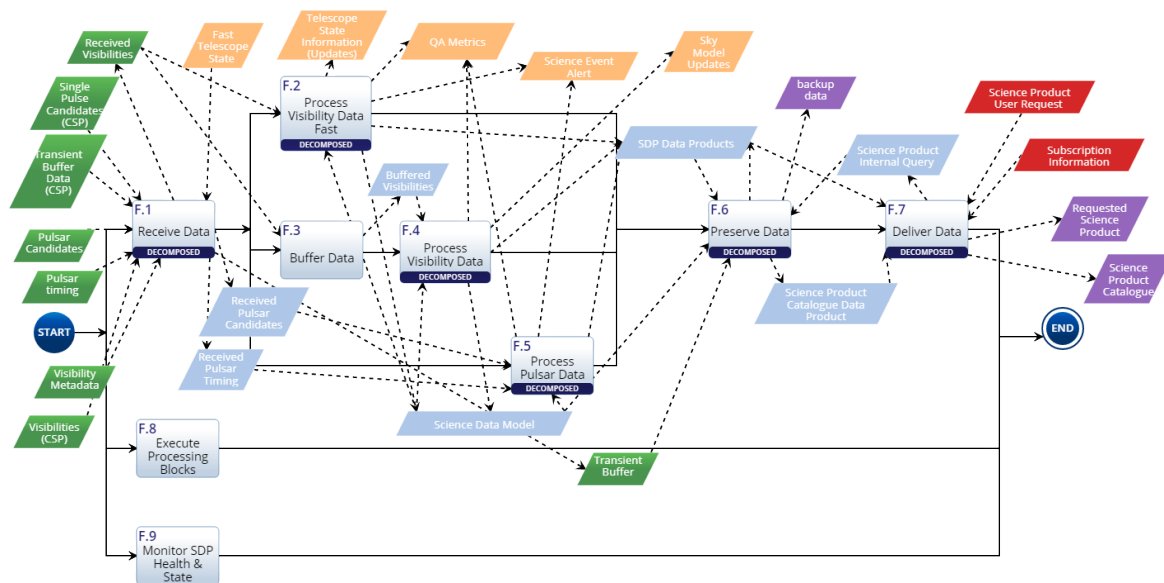


Figure 2: Action diagram for SDP Functions as per Innoslate²

² A product lifecycle management tool used in the systems engineering of the SDP

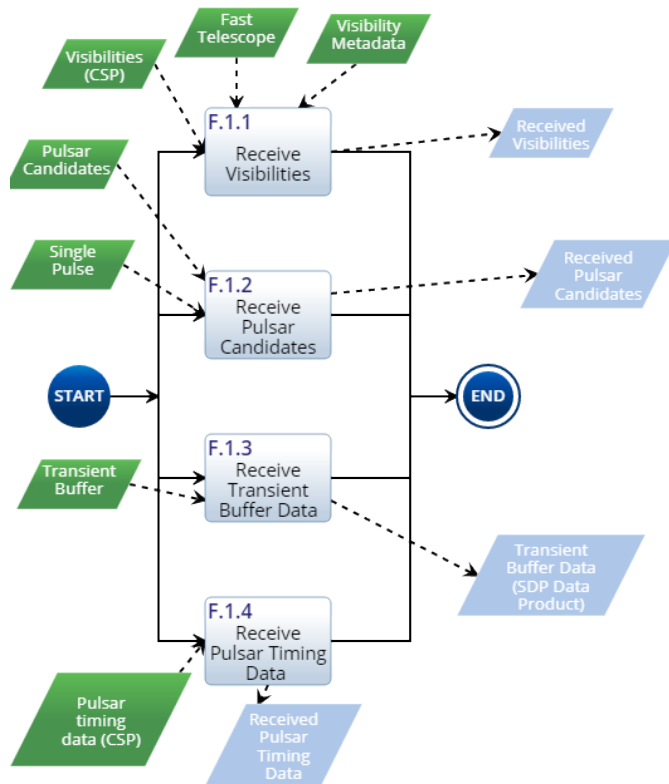


Figure 3: Action diagram for SDP F1 Receive, as per Innoslate

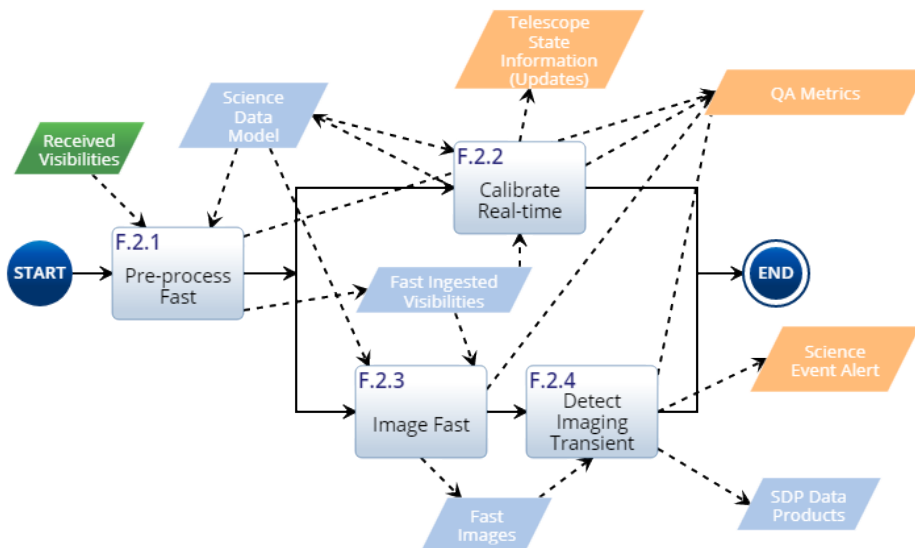


Figure 4: Action diagram for SDP F2 Process Visibility Data Fast, as per Innoslate

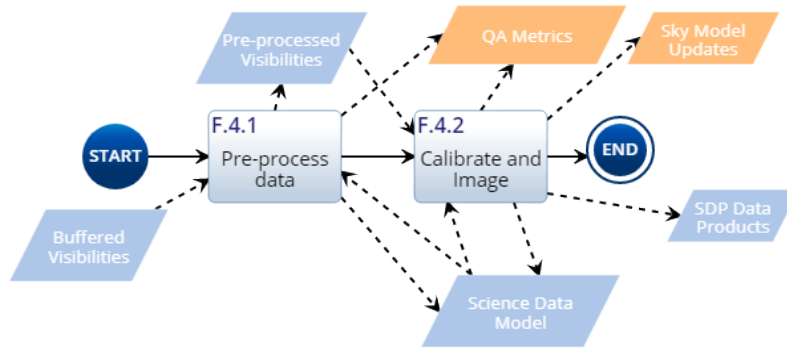


Figure 5: Action diagram for SDP F4 Process Visibility Data, as per Innoslate

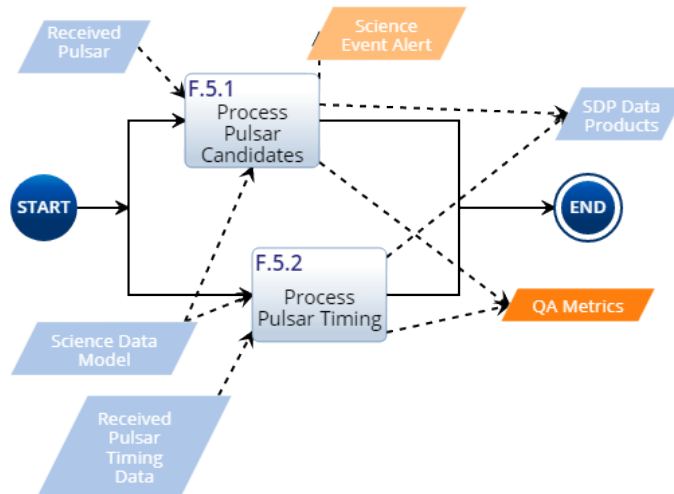


Figure 6: Action diagram for SDP F4 Process Pulsar Data, as per Innoslate

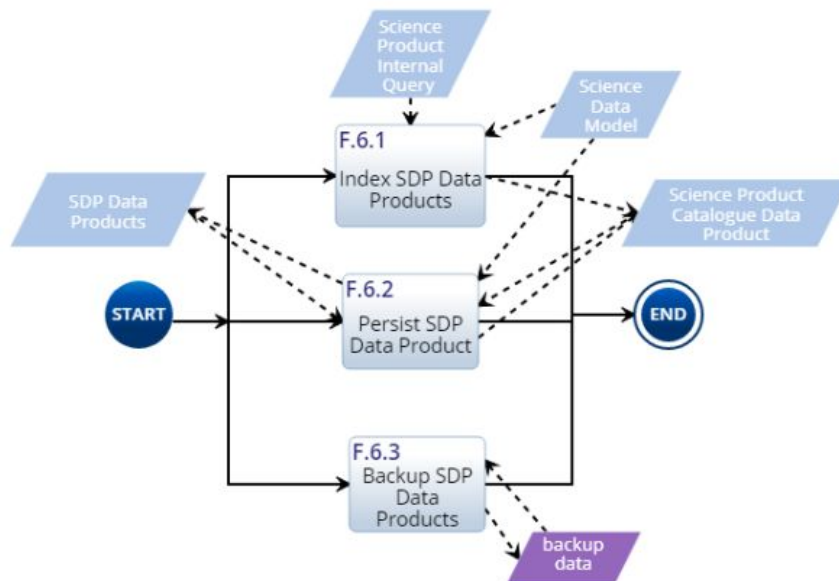


Figure 7: Action diagram for SDP F.6 Preserve Data, as per Innoslate

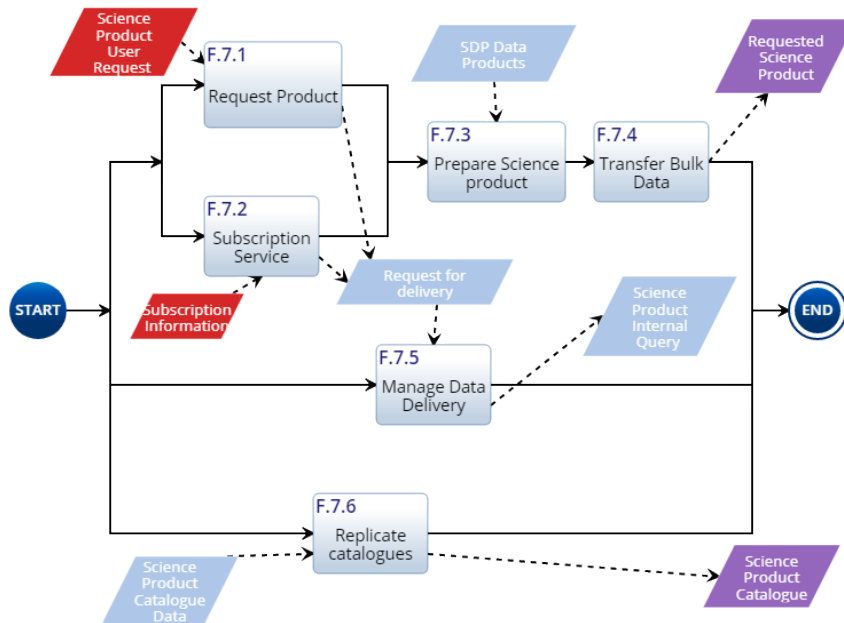


Figure 8: Action diagram for SDP F.7 Deliver Data, as per Innoslate

3. Context Diagram

Figure 3 in the SDP Architecture Overview serves as a good Context Diagram for this View.

Note: Previous SDP functional models included Observatory Support Tools. This is not within the scope of this view.

4. Rationale

4.1. Primary Functionality

The primary functionality of the SDP is derived from the SDP L2 requirements [RD02]. This is user required functionality and therefore an implementation-free representation.

[RD1] defines Primary Functionality as follows:

“Functionality of the system to do the work for which it was intended. Primary functionality is usually defined as functionality that is critical to achieve the business goals that motivate the development of the system”. p 272 [RD1].

The functional decomposition in this view is based on a functional model. Depending on an individual’s background or expectations, he/she may have different ideas of what a functional model should look like. This model focuses on **primary functionality** and serves to complement the other SDP Architecture Views. Non-functional aspects and derived or implied functionality are not modelled here as these aspects are represented (and

rationalised) more clearly in the other views, using the Views and Beyond approach. The functional model shown here is therefore not a complete or detailed functional model of the SDP system, but meant to supplement the SDP Architecture Views. This approach is significantly different from the classical [FFBD style](#) of functional modelling (where the sequential relationship of all functions that must be accomplished by a system are modelled).

SEI also advocates other definitions of functions, e.g. functions that require a high level of technical difficulty, or require interaction with several architectural elements. The focus in this case, however, is "motivating the development of the system" i.e. what the SDP is really intended to do.

5. Related Views

There are no parent and children views for this view.

6. References

6.1. Applicable Documents

The following documents are applicable to the extent stated herein. In the event of conflict between the contents of the applicable documents and this document, **the applicable documents** shall take precedence.

[AD01] SDP Product Breakdown Structure, SKA-TEL-SDP-0000064 Rev 2C

6.2. Reference Documents

The following documents are referenced in this document. In the event of conflict between the contents of the referenced documents and this document, **this document** shall take precedence.

[RD01] Designing Software Architectures: A Practical Approach (SEI Series in Software Engineering) 1st Edition, by Humberto Cervantes, Rick Kazman

[RD02] SKA-TEL-SDP-0000033, SDP L2 Requirements

[RD03] SKA-TEL-SDP-0000047, SDP Construction and Verification Plan

7. Version History

Version	Date of Issue	Prepared by	Comments
1	2018-04-25	L Christelis	Prepared for SDP Pre-CDR review