

Software Requirements Specification (SRS)  
and  
Interface Control Document (ICD)

Open Data Interface (ODI)  
ESTEC/Contract No. 21964/08/NL/AT

May 3, 2010

Prepared by:

---

Peter Wintoft  
Swedish Institute of Space Physics

---

Daniel Heynderickx  
DH Consultancy

Approved by:

---

Lars Eliasson  
Swedish Institute of Space Physics

---

Hugh Evans  
ESA/ESTEC

---

Annika Tenho  
ESA/ESTEC

**Document status sheet**

Version	Date	Comment
0.1	2008-11-14	First draft.
1.0	2009-09-22	Major revision.
1.1	2010-05-03	Updated.

## Contents

<b>1</b>	<b>Introduction</b>	<b>4</b>
<b>2</b>	<b>Applicable and reference documents</b>	<b>4</b>
<b>3</b>	<b>Terms, definitions and abbreviated terms</b>	<b>4</b>
<b>4</b>	<b>Software overview</b>	<b>4</b>
4.1	Function and purpose . . . . .	4
4.2	Environmental considerations . . . . .	5
4.3	Relation to other systems . . . . .	5
4.4	Constraints . . . . .	5
4.5	Logical model description . . . . .	5
<b>5</b>	<b>Requirements</b>	<b>5</b>
5.1	Functional requirements . . . . .	5
5.2	Performance requirements . . . . .	7
5.3	Interface requirements . . . . .	8
5.4	Operational requirements . . . . .	9
5.5	Resource requirements . . . . .	9
5.6	Design requirements and implementation constraints . . . . .	9
5.7	Security and privacy requirements . . . . .	10
5.8	Portability requirements . . . . .	11
5.9	Software quality requirements . . . . .	11
5.10	Software reliability requirements . . . . .	11
5.11	Software maintainability requirements . . . . .	11
5.12	Software safety requirements . . . . .	11
5.13	Software configuration and delivery requirements . . . . .	11
5.14	Data definition and database requirements . . . . .	11
5.15	Human factors related requirements . . . . .	12
5.16	Adaptation and installation requirements . . . . .	12
5.17	Others requirements . . . . .	12
<b>6</b>	<b>Validation approach and requirements</b>	<b>12</b>
6.1	Validation approach . . . . .	12
6.2	Validation requirements . . . . .	12
<b>7</b>	<b>Traceability</b>	<b>15</b>

## 1 Introduction

This document describes the functional and non-functional software requirements applicable to the ODI system. The requirements build on the Software System Specification (ODI/SSS). This document also includes the Interface Control Document (ICD) as part of Section 5.3.

## 2 Applicable and reference documents

**ODI/SOW** ODI Statement of Work

**ODI/SSS** ODI Software System Specification

**ODI/TN/DB** Technical Note on the ODI Database

**ODI/TN/SSS** TN on SAAPS/SEDAT/SPENVIS adaption for ODI

**E401B** ECSS-E40 Part 1B

**E402B** ECSS-E40 Part 2B

## 3 Terms, definitions and abbreviated terms

**CDF** Common Data Format

**ODI** Open Data interface

**PRBEM** Panel on Radiation Belt Environment Modeling

**SAAPS** Satellite Anomaly Analysis and Prediction System

**SEDAT** Space Environment Data Analysis Tool

**SOW** Statement of Work for ESTEC/Contract No. 21964/08/NL/AT

**SPENVIS** Space Environment Information System

**SQL** Structured Query Language

## 4 Software overview

### 4.1 Function and purpose

The ODI system shall store data and metadata compliant with the ISTP/PRBEM Guidelines. Three existing systems, SAAPS, SEDAT, and SPENVIS, shall be updated to use ODI as a common access point for data.

## 4.2 Environmental considerations

The ODI system is targeted to run on an Open Suse Linux platform.

## 4.3 Relation to other systems

ODI shall not rely on other systems for its operation.

## 4.4 Constraints

As stated in the ODI/SOW the ODI system shall build on a MySQL database. This enables fast access and advanced searching of data from the database, and platform independence.

## 4.5 Logical model description

At the core of the ODI system is the database. The database contains both data and metadata. One of the requirements is to be able to store data from CDF files following ISTP Guidelines. The ODI system provides methods to read/write data and its associated metadata from/to the database. As the ODI system shall be able to read/write CDF/ISTP files it must be able to store all necessary data associated with CDF/ISTP files. This is accomplished by using a syntax for the ODI metadata that builds on the syntax of the CDF/ISTP data. As CDF/ISTP is a generic format for storing space physics data then the ODI system will also have the same capability. However, as ODI uses a MySQL database data from any source can be stored provided a parser exists. Parsers for CDF/ISTP files and a number of other text based data files shall be developed. A detailed description of the ODI logical model can be found in ODI/TN/DB.

Software systems that make use of the ODI database can then be developed. In this project three systems will be adapted: SAAPS, SEDAT, and SPENVIS. The details are described in ODI/TN/SSS.

# 5 Requirements

## 5.1 Functional requirements

### 5.1.1 Store data

**Description:** Processed data are stored into the ODI database following the principles defined in ODI/TN/DB. The ODI database model (Section 5 in ODI/TN/DB) describes how to store data compliant with CDF/ISTP/PRBEM guidelines.

**Source:** SSS.ODI.CAP.4

### 5.1.2 Store metadata

**Description:** Processed metadata are stored into the ODI database following the principles defined in ODI/TN/DB. The ODI database model (Section 5 in ODI/TN/DB) describes how to store metadata compliant with CDF/ISTP/PRBEM guidelines.

**Source:** SSS.ODI.CAP.5

### 5.1.3 Create dataset

**Description:** Create a new dataset in the ODI database following the principles defined in ODI/TN/DB (Section 6.2).

**Source:** SSS.ODI.CAP.6

### 5.1.4 Scheduled update of dataset

**Description:** Update a dataset in the ODI database based on schedule following the principles defined in ODI/TN/DB (Section 7.2).

**Source:** SSS.ODI.CAP.7

### 5.1.5 List high level metadata for the datasets

**Description:** List the high level metadata for the datasets in the ODI database. The high level metadata are the name of the dataset, the number of records in the dataset, the epoch range of the dataset (ODI/TN/DB Section 8.1).

**Source:** SSS.ODI.CAP.8, SSS.ODI.CAP.9

### 5.1.6 Return the metadata for a dataset

**Description:** Return the metadata for a dataset in the ODI database (ODI/TN/DB Section 8.1).

**Source:** SSS.ODI.CAP.10, SSS.ODI.CAP.13

### 5.1.7 Export a dataset to an ASCII file

**Description:** For given dataset, epoch range and variables, export the data to an ASCII file (ODI/TN/DB Section 8.4).

**Source:** SSS.ODI.CAP.11

### 5.1.8 Export a dataset to an ISTP/PRBEM compliant CDF file

**Description:** For given dataset, epoch range and variables, export the data to a CDF file (ODI/TN/DB Section 8.5).

**Source:** SSS.ODI.CAP.12

#### **5.1.9 Interface to read data and metadata**

**Description:** In ODI/TN/DB a standard interface is defined that can be used to read data and metadata from the ODI database (ODI/TN/DB Section 8.4).

**Source:** SSS.ODI.CAP.14

#### **5.1.10 Library routines to read data and metadata in ITT/IDL**

**Description:** In ODI/TN/DB a standard interface is defined that can be used to read data and metadata from the ODI database. The function is implemented in ITT/IDL. Section ? in ODI/TN/DB and Section ? in ODI/TN/SSS.

**Source:** SSS.ODI.CON.4

#### **5.1.11 SAAPS implementation of the standard interface to read data and metadata**

**Description:** In ODI/TN/DB a standard interface is defined that can be used to read data and metadata from the ODI database. A SAAPS function is implemented based on that interface (ODI/TN/SSS).

**Source:** SSS.ODI.CAP.1, SSS.ODI.CAP.15

#### **5.1.12 SEDAT implementation of the standard interface to read data and metadata**

**Description:** In ODI/TN/DB a standard interface is defined that can be used to read data and metadata from the ODI database. A SEDAT function is implemented based on that interface (ODI/TN/SSS).

**Source:** SSS.ODI.CAP.1, SSS.ODI.CAP.16

#### **5.1.13 SPENVIS implementation of the standard interface to read data and metadata**

**Description:** In ODI/TN/DB a standard interface is defined that can be used to read data and metadata from the ODI database. A SPENVIS function is implemented based on that interface (ODI/TN/SSS).

**Source:** SSS.ODI.CAP.1, SSS.ODI.CAP.17

### **5.2 Performance requirements**

#### **5.2.1 Extract 50 000 records in less than one second**

**Description:** The system shall provide on average at least 50 000 data records in less than a second using a direct MySQL connection locally on the system.

**Source:** SSS.ODI.CON.5

### 5.3 Interface requirements

The ODI system is delivered with all the necessary software to function, including SAAPS, SEDAT and SPENVIS, but excluding the MySQL database server. Here we list all interfaces to ODI.

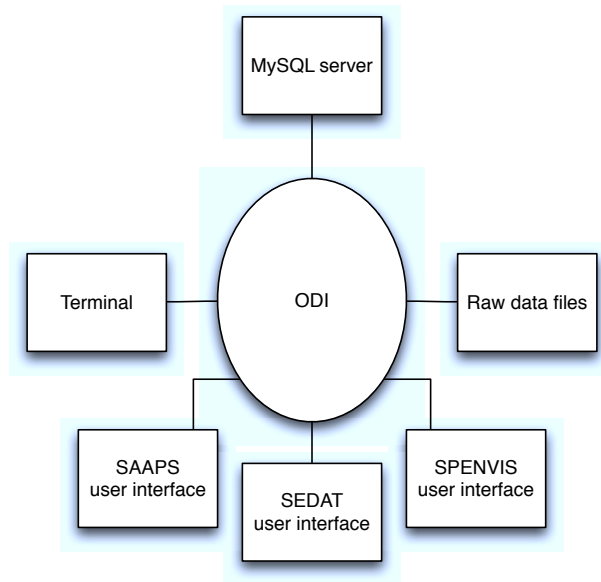


Figure 1: The ODI interfaces.

#### 5.3.1 Terminal window

**Description:** The basic communication with ODI is at the command prompt using a terminal window.

**Source:** -

#### 5.3.2 Raw data files

**Description:** New data are ingested into ODI from raw data files. The files may exist locally on the server or remotely (ftp, http).

**Source:** -

#### 5.3.3 Database

**Description:** Data in the ODI system is written to and read from a MySQL database server.

**Source:** SSS.ODI.CON.1

#### **5.3.4 SAAPS**

**Description:** SAAPS provides a graphical user interface.

**Source:** SSS.ODI.CAP.1

#### **5.3.5 SEDAT**

**Description:** SEDAT provides a graphical user interface.

**Source:** SSS.ODI.CAP.1

#### **5.3.6 SPENVIS**

**Description:** SPENVIS provides a graphical user interface.

**Source:** SSS.ODI.CAP.1

### **5.4 Operational requirements**

#### **5.4.1 ODI server connected to the internet via TCP/IP**

**Description:** The ODI server is connected to the internet via TCP/IP.

**Source:** SSS.ODI.CON.3

### **5.5 Resource requirements**

### **5.6 Design requirements and implementation constraints**

#### **5.6.1 Store data and metadata in a MySQL database**

**Description:** All data and metadata are stored in a MySQL database (ODI/TN/DBSection 3).

**Source:** SSS.ODI.CON.1

#### **5.6.2 Code targeted for Open Suse Linux**

**Description:** The system should at least run on an Open Suse Linux platform.

**Source:** SSS.ODI.CON.2

#### **5.6.3 Firewall**

**Description:** Limit communication protocols to those permitted by the ESA firewall:  
HTTP, HTTPS, FTP, Telnet.

**Source:** SSS.ODI.CON.6

#### 5.6.4 Freeware

**Description:** Use freeware if not stated otherwise by the Agency. MySQL is free for non-commercial use. PHP is free. Java is free. IDL/Dataminer has been provided by Estec.

**Source:** SSS.ODI.CON.7

#### 5.6.5 Only implement read functionality for SAAPS

**Description:** Only implement the possibility to read data from the ODI database in the SAAPS system. SAAPS connects at user level 3 (ODI/TN/DB and ODI/TN/SSS).

**Source:** SSS.ODI.CON.9

#### 5.6.6 Only implement read functionality for SEDAT

**Description:** Only implement the possibility to read data from the ODI database in the SEDAT system. SEDAT connects at user level 3 (ODI/TN/DB and ODI/TN/SSS).

**Source:** SSS.ODI.CON.10

#### 5.6.7 Only implement read functionality for SPENVIS

**Description:** Only implement the possibility to read data from the ODI database in the SPENVIS system. SEDAT connects at user level 3 (ODI/TN/DB and ODI/TN/SSS).

**Source:** SSS.ODI.CON.11

### 5.7 Security and privacy requirements

#### 5.7.1 ODI database administrator user (U1)

**Description:** Set up a MySQL user that has full access to the ODI database (ODI/TN/DB).

**Source:** SSS.ODI.CON.12

#### 5.7.2 ODI database update user (U2)

**Description:** Set up a MySQL user that has read, write, and update permissions to the ODI database (ODI/TN/DB).

**Source:** SSS.ODI.CON.13

### **5.7.3 ODI database read user (U3)**

**Description:** Set up a MySQL user that has only read permission to the ODI database (ODI/TN/DB).

**Source:** SSS.ODI.CON.14

## **5.8 Portability requirements**

## **5.9 Software quality requirements**

## **5.10 Software reliability requirements**

## **5.11 Software maintainability requirements**

## **5.12 Software safety requirements**

## **5.13 Software configuration and delivery requirements**

### **5.13.1 ITT/IDL/Dataminer**

**Description:** ITT/IDL and IDL/Dataminer is payed and installed by the Agency.

**Source:** SSS.ODI.CON.8, SSS.ODI.CON.17

### **5.13.2 SSH**

**Description:** Installed SSH.

**Source:** SSS.ODI.CON.15

### **5.13.3 MySQL**

**Description:** Installed MySQL server.

**Source:** SSS.ODI.CON.16

### **5.13.4 PHP**

**Description:** Installed PHP with MySQL libraries.

**Source:** SSS.ODI.CON.18, SSS.ODI.CON.19

## **5.14 Data definition and database requirements**

### **5.14.1 ODI data**

**Description:** Store the available data for the datasets given in Table 1 in the ODI/TN/DB.

**Source:** SSS.ODI.CAP.2

#### **5.14.2 ODI metadata**

**Description:** Store the available metadata for the datasets given in Table 1 in the ODI/TN/DB.

**Source:** SSS.ODI.CAP.3

#### **5.15 Human factors related requirements**

#### **5.16 Adaptation and installation requirements**

##### **5.16.1 Update SAAPS to SAAPS/ODI**

**Description:** The SAAPS system is updated so that it reads the data and metadata from the ODI database (ODI/TN/SSS).

**Source:** SSS.ODI.CAP.18

##### **5.16.2 Update SEDAT to SEDAT/ODI**

**Description:** The SEDAT system is updated so that it reads the data and metadata from the ODI database (ODI/TN/SSS).

**Source:** SSS.ODI.CAP.19

##### **5.16.3 Update SPENVIS to SPENVIS/ODI**

**Description:** The SPENVIS system is updated so that it reads the data and metadata from the ODI database (ODI/TN/SSS).

**Source:** SSS.ODI.CAP.20

#### **5.17 Others requirements**

### **6 Validation approach and requirements**

#### **6.1 Validation approach**

The functional and non-functional requirements are given in Section 5. The validation is performed manually in a command window.

#### **6.2 Validation requirements**

##### **6.2.1 Requirements 5.6.2, 5.6.3**

Run all tests on an Open Suse Linux platform at ESA behind the ESA firewall.

**6.2.2 Requirement 5.13.2**

Connect to the server using SSH.

**6.2.3 Requirements 5.7.1, 5.7.2, 5.7.3, 5.13.3**

Use the interactive `mysql` SQL shell and log in as admin user (U1). Inspect the grant tables and verify the setting for U1, U2, and U3.

**6.2.4 Requirement 5.13.4**

Run PHP test program to check that PHP is installed and can connect to the MySQL database.

**6.2.5 Requirements 5.1.1, 5.1.2, 5.1.3, 5.6.1**

Run program to ingest metadata and data for a few selected datasets, both CDF and non-CDF data. For each dataset inspect that:

- the dataset has been created in ODI;
- the metadata in ODI match the metadata in the raw dataset;
- the number of variables in ODI match the number of variables in the raw dataset;
- the data for a few selected records in ODI match the data in the raw dataset.

The inspections are made using a combination of the ODI command line tools and the interactive `mysql` SQL shell.

**6.2.6 Requirement 5.1.4**

Install the real time updating of the GOES dataset and inspect that the data are updated.

**6.2.7 Requirement 5.1.5**

Run program to list the datasets. Inspect the listed high level metadata.

**6.2.8 Requirement 5.1.6**

Run program to list the metadata for a specified dataset. Inspect the listed metadata.

**6.2.9 Requirement 5.14.1**

Use the ODI tool to list the datasets in ODI. Verify that all sets in Table 1 in ODI/TN/DB exist.

**6.2.10 Requirement 5.14.2**

Use the ODI tool to inspect the metadata for each dataset. Verify that the metadata in the raw data files exist.

**6.2.11 Requirement 5.1.7**

Run program to export a dataset to ascii file. Inspect the contents of the file and verify against the data in ODI.

**6.2.12 Requirement 5.1.8**

Run program to export a dataset to CDF file. Inspect the contents of the file and verify against the data in ODI.

**6.2.13 Requirements 5.1.11, 5.16.1**

Start the SAAPS software. Select the Data Plotter tool. Select a dataset and plot data for a selected epoch range. Inspect metadata and data.

**6.2.14 Requirements 5.1.12, 5.16.2**

Start the SEDAT software. ...

**6.2.15 Requirements 5.1.13, 5.16.3**

Start the SPENVIS software. ...

**6.2.16 Requirement 5.2.1**

Run a dedicated test program that extracts 50 000 records and times the result. Verify that the extraction took less than one second.

**6.2.17 Requirement 5.1.9, 5.1.10, 5.13.1**

Run a dedicated IDL test program that reads data and metadata from ODI and displays the result.

**6.2.18 Requirement 5.4.1**

Make a SSH connection to an external computer.

**6.2.19 Requirement 5.6.5**

Start the SAAPS application and verify that there are no possibility to write data to ODI.

**6.2.20 Requirement 5.6.6**

Start the SEDAT application and verify that there are no possibility to write data to ODI.

**6.2.21 Requirement 5.6.7**

Start the SPENVIS application and verify that there are no possibility to write data to ODI.

**7 Traceability**

The traceability is given in two tables: forward traceability (SSS to SRS) and backward traceability (SRS to SSS).

Table 1: Forward traceability.

SSS	SRS
CAP.1	5.1.11, 5.1.12, 5.1.13
CAP.2	5.14.1
CAP.3	5.14.2
CAP.4	5.1.1
CAP.5	5.1.2
CAP.6	5.1.3
CAP.7	5.1.4
CAP.8	5.1.5
CAP.9	5.1.5
CAP.10	5.1.6
CAP.11	5.1.7
CAP.12	5.1.8
CAP.13	5.1.6
CAP.14	5.1.9
CAP.15	5.1.11
CAP.16	5.1.12
CAP.17	5.1.13
CAP.18	5.16.1
CAP.19	5.16.2
CAP.20	5.16.3
CON.1	5.13.3
CON.2	5.6.2
CON.3	5.4.1
CON.4	5.1.10
CON.5	5.2.1
CON.6	5.6.3

Table 1: (continued)

<b>SSS</b>	<b>SRS</b>
CON.7	5.6.4
CON.8	5.13.1
CON.9	5.6.5
CON.10	5.6.6
CON.11	5.6.7
CON.12	5.7.1
CON.13	5.7.2
CON.14	5.7.3
CON.15	5.13.2
CON.16	5.13.3
CON.17	5.13.1
CON.18	5.13.4
CON.19	5.13.4

Table 2: Backward traceability.

<b>SRS</b>	<b>SSS</b>
5.1.1	CAP.4
5.1.2	CAP.5
5.1.3	CAP.6
5.1.4	CAP.7
5.1.5	CAP.8, CAP.9
5.1.6	CAP.10, CAP.13
5.1.7	CAP.11
5.1.8	CAP.12
5.1.11	CAP.1, CAP.15
5.1.12	CAP.1, CAP.16
5.1.13	CAP.1, CAP.17
5.2.1	CON.5
5.1.9	CAP.14
5.1.10	CON.4
5.4.1	CON.3
5.6.1	CON.1
5.6.2	CON.2
5.6.3	CON.6
5.6.4	CON.7
5.6.5	CON.9
5.6.6	CON.10
5.6.7	CON.11
5.7.1	CON.12

Table 2: (continued)

<b>SRS</b>	<b>SSS</b>
5.7.2	CON.13
5.7.3	CON.14
5.13.1	CON.8, CON.17
5.13.2	CON.15
5.13.3	CON.16
5.13.4	CON.18, CON.19
5.14.1	CAP.2
5.14.2	CAP.3
5.16.1	CAP.18
5.16.2	CAP.19
5.16.3	CAP.20