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CHANGE RECORD

ISSUE	DATE	PAGE	DESCRIPTION OF CHANGES	RELEASE
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1 INTRODUCTION

1.1 Scope and Purpose of the Document

The scope of the present document is the AGILE Ground Segment, in the framework sketched in Figure -1-1 below, and detailed in AD[1].

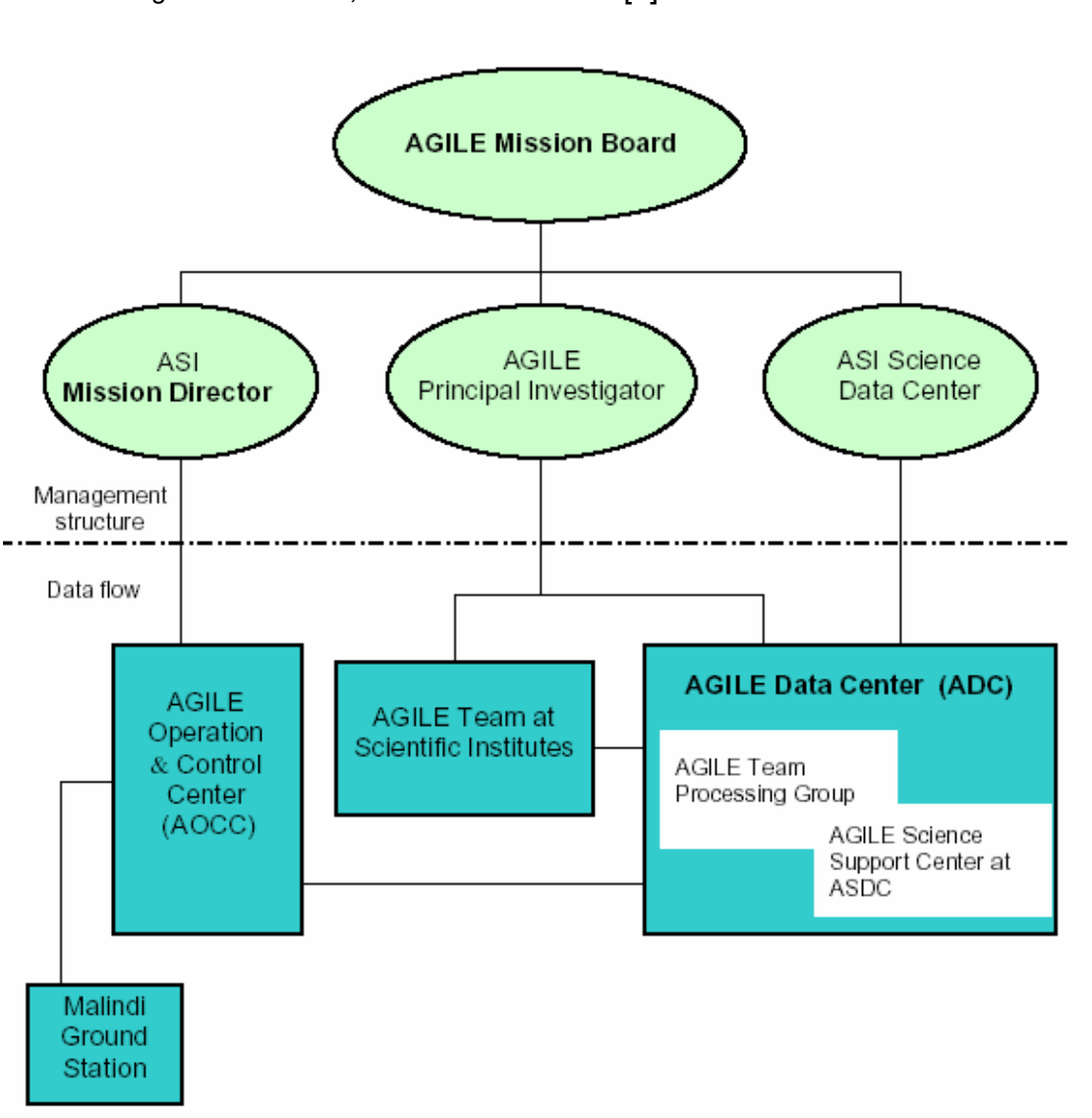

Figure -1-1 AGILE Ground Segment organization and data flow (as stated in AD[1])

In this framework, the Agile Team is in charge of the development and maintenance of s/w subsystems and s/w modules to be exploited at ASDC and/or at the AGILE Team Scientific Institutes during the Agile mission, namely:

- Pre-Processing

- Data Correction
- Payload Configuration Control
- Health and Performance Monitoring
- Quick Look Analysis
- Standard Analysis
- Calibration & Response Analysis
- Scientific Analysis

This document is aimed at defining all the relevant interfaces.

1.2 Document Overview

1.3 Acronyms

AC	Anti-coincidence auxiliary subsystem
AOCC	AGILE Operation & Control Center
ASDC	Agile Science Data Center
ASC	APID Sequence Counter
AUX	Auxiliary Data
Calibration MGSE	Calibration Mechanical Ground Support Equipment
CCOE	Central Checkout Equipment
EGSE	Electrical Ground Support Equipment
GSE	Ground Support Equipment
Instrument SC	Instrument Science Console
IP	Integrated Payload
L0	Level-0
L1	Level-1
MCAL	Mini-calorimeter detector
PD	Photo Diode
PDHU	Payload Data handling Unit
PPS	Pre-Processing System

PSC	Packet Sequence Count
SA	X-Ray detector named Super-AGILE
ST	Silicon Tracker gamma-ray detector
TBC	To Be Confirmed
TBD	To Be Defined
TC	Telecommand
TE	Test Equipment
TM	Telemetry

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable Documents

AD [1] ASI and IASF, AGILE Science Management Plan, Version x.y, date

AD [2] Agile Team, Scientific Ground Segment Software Requirements and Architecture, Issue 2, 24/10/2006

AD [3] RTI, Ground segment requirement document, AGRTI-RQ-TPZ-001

AD [4] RTI, Ground Segment Interface Control Document CCE-ICD-001-180.320, Issue 4.1, 12/12/2005

AD [5] AGILE RTI COMMUNICATION ICD AGRTI-IC-CGS-002, Issue 2.0, 15 Jan. 04

AD [6] AGILE Tables ICD AGILE-AST-TN-015 Issue 1.0

2.2 Reference Documents

The following is a list of documents that are referenced within the text of this document:

2.3 Document Priority

A priority in the applicability of documents is established as follows:

1. AGILE Scientific Requirements
2. P/L System Requirements
3. Current Document
4. Applicable Documents
5. Minutes of Meeting

In case of conflict among technical material contained in these documents, the highest rank document shall have the precedence.

3 SYSTEM CONTEXT

As already mentioned, the Agile Team participates to the development and maintenance of the following AGILE s/w subsystems:

- Pre-Processing
- Data Correction
- Payload Configuration Control
- Health and Performance Monitoring
- Quick Look Analysis
- Standard Analysis
- Calibration & Response Analysis
- Scientific Analysis

As sketched in Figure 3-1 , there are different environments where the s/w is run and the s/w activities are carried out:

- Agile Team Institutes
- ASDC Automatic Environment
- ASDC Interactive Environment
- ASDC Front End Environment

3.1 AGILE Team Institutes

In the scope of the present document, the s/w activities to be carried out at the Agile Team Institutes are mainly related to:

- development, maintenance and test of the s/w for ASDC
- P/L Configuration & Control
- P/L Health Monitoring
- P/L Performance Monitoring
- Remote Access to Grid Interactive QLA
- Super Agile Refined Analysis
- Agile Team Data Analysis Projects

The Agile Team Institutes have established a common h/w and s/w development environment which is based on:

- HP Server
- Operating System Linux Suse 9.2 (32 bit)
- Open Source s/w external libraries

- CVS s/w configuration control.

The CVS Server is maintained at IASF Bologna. The s/w for ASDC is structured into the following main blocks:

- Telemetry Pre-Processing Pipeline (TMPPS)
- Data Correction modules (Grid + SuperAgile)
- Grid Pipeline modules
- Reference Test Data

For the time being, the SuperAgile Pipeline is maintained at the level of tar files.

3.2 ASDC Automatic Environment

Most of the ASDC s/w to be provided by the Agile Team is run in the hardware and software environment established at ASDC for the automatic standard processing. This environment consists of various computers which are devoted to the routine tasks to be performed on the Agile Data (e.g. every satellite contact or daily). In this case, the s/w in operated automatically, using pre-defined standard setting.

3.3 ASDC Interactive Environment

This environment hosts all the s/w related to interactive standard processing. This is the case of the Grid Interactive Quick Look Analysis (QLA), where the user is able to run the standard s/w using a custom setting. The application is fed with the input data selected through the DB and available in the NAS archive, and generates the output data on the local disk, without interfering with the automatic standard processing.
This Environment is also accessible remotely by authorized Agile Team Institutes, which shall also be authorized to get locally the data products of the analysis.

3.4 ASDC Front End Environment

The ASDC Front End Environment allows the Agile Team Institutes to interface ASDC with the s/w applications running at the Agile Team Institutes (e.g. SuperAgile refined analysis) and with the development, maintenance and testing activities to be carried out at the Agile Team Institutes for the ASDC s/w.
As sketched in Figure 3-1, the Front End Environment is meant as the environment where the required data and APIs (e.g. remote connect to the Data Base) are made available through secure access to the NAS Archive and through data base mirroring.

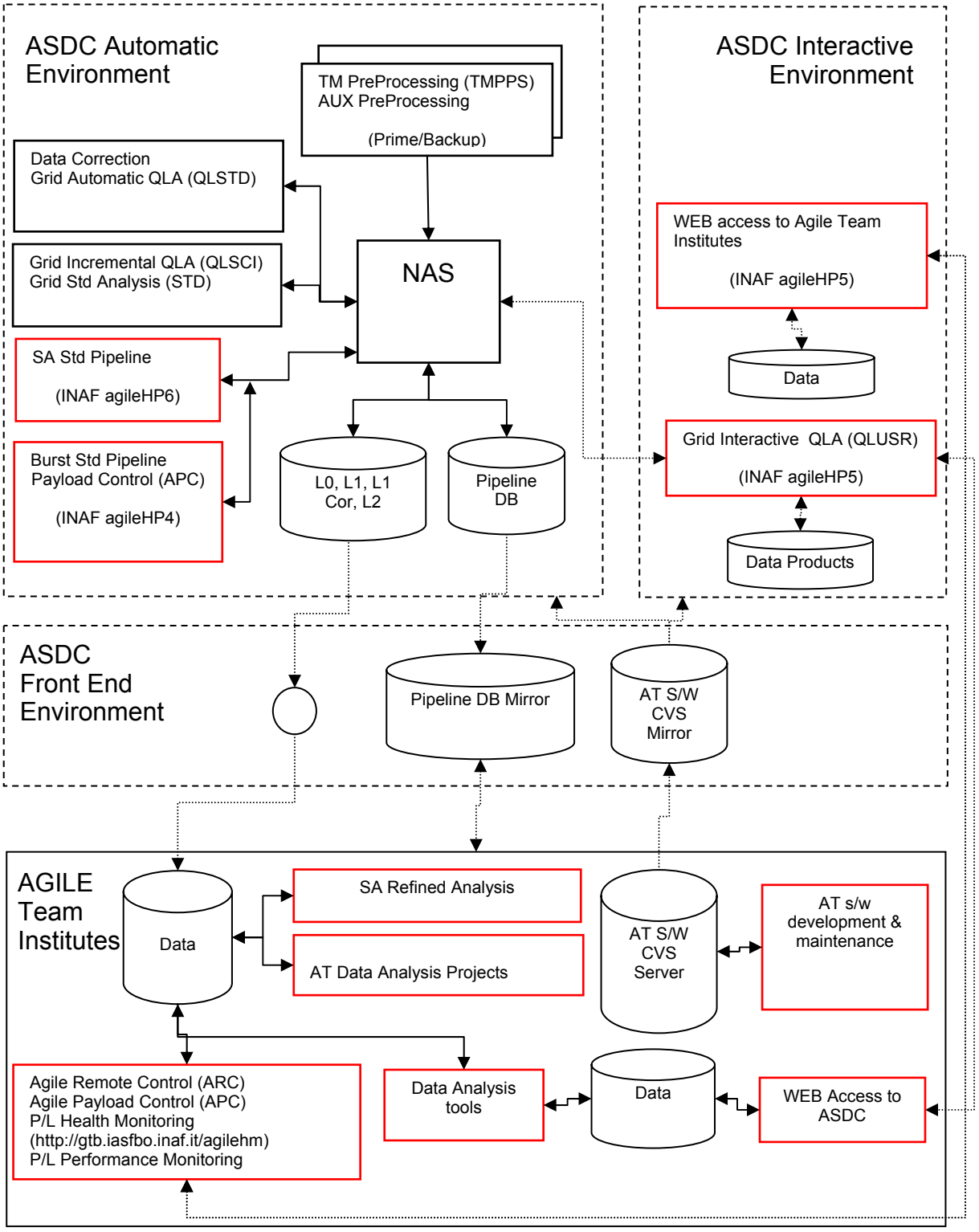

Figure 3-1 Agile Team Institutes / ASDC I/F diagram

4 ASDC AUTOMATIC ENVIRONMENT

4.1 Telemetry Pre-Processing Subsystem (TMPPS)

4.1.1 DESCRIPTION

The TMPPS acquires, archives and processes the VC0 and VC1 files transferred by AOCC to ASDC after each satellite pass over the Ground Station.
The TMPPS is run in parallel on the two Pre-Processing Computers (PPS1, PPS2) in order to provide a redundant system which purpose is to archive on the NAS computer each VC0 and VC1 file and the related L1 files.
Each computer receives one copy of each VC0 and VC1 file. Each copy is processed to generate the corresponding L1 files. Both the L0, the L1 files and the Log files are archived locally. On each computer, the TMPPS manages and keep tracks of all the operations using a local Data Base (TMPPSDB).
Using a “first come first served” mechanism, one of the two PPS computers gets access to the NAS computer in order to archive on the NAS disks the L0 file, the L1 files and the Log files and to populate the related tables in the NAS Data Base (ADCDB).

4.1.2 INTERNAL I/F

4.1.2.1 ACCESS TO THE NAS DISKS

Both PPS computers mount the NAS Disks using NFS in order to have write access to the area devoted to:

- the TMPPS Consolidated Archive, where the TMPPS copies the L0, L1, Log files
- the TMPPS Synch Area, where the TMPPS creates the “synchronization” files which notify the result of the VC0 and VC1 files processing.

4.1.2.2 ACCESS TO THE NAS DATA BASE

Both PPS computers have access to the NAS Data Base in order to:

- connect the DB
- populate the TMPPS Tables

4.1.3 EXTERNAL I/F

4.1.3.1 AOCC TO ASDC

Both PPS computers provides the ftp user devoted to the acquisition of the VC0 and VC1 files.

4.1.4 SW MANAGEMENT

4.1.4.1 RESPONSIBILITY

The TMPPS development and maintenance is in charge of the Agile Team (IASF Bologna) at the level of Subsystem.

4.1.4.2 MAINTENANCE

The TMPPS is kept under configuration control using CVS and consists of:

- the build module (Makefile, user profile and installation scripts, DB scripts, docs)
- one module for each s/w component (libraries, Processors, Engine, Packet Viewer, …)
- one module for the test data (input L0 data, output L1 data).

The Build module contains the Makefile to be used in order to:

- perform the checkout of each s/w component (make checkout)
- compile and link each s/w module and install the s/w under the installation directory (make install)

4.1.4.3 DELIVERY

Each s/w delivery is identified by the TMPPSxxx CVS Tag.

4.1.4.4 INSTALLATION

The installation procedure is specified in the Build Release document, included in the s/w delivery.
Each Build is installed under its own directory.
The active Build is identified by the symbolic link “$HOME/local” pointing to the specific “local” directory (e.g. $HOME/local.TMPPS002).

4.1.5 USAGE

The TMPPS is automatically run at system startup.

4.2 Data Correction Modules

4.2.1 DESCRIPTION

The Data Correction is applied to the L1 data to produce Cor data (Corrected) in which some simple correction / conversions / etc.. have been applied (e.g. time conversions). These involve only information already present in the L1 data.

The Correction is performed by several individual Corrector modules, each specific to a particular telemetry packet/sub-packet.

4.2.2 INTERNAL I/F

Correction Modules require:

- read access to the NAS Disks in order to read LV1 files
- write access to the NAS Disks in order to write the COR and INDEX files.

4.2.3 EXTERNAL I/F

Corrector modules products will be retrievable by authorized AGILE Team Members through WEB I/F provided by ASDC.

4.2.4 SW MANAGEMENT

4.2.4.1 RESPONSIBILITY

The Data Correction development and maintenance is in charge to the Agile Team (IASF Milano for the GRID, IASF-Rm for SA) at the level of the single Modules.
The ASDC is responsible for the integration of the Modules into the Correction pipeline and its maintenance and operation.

4.2.4.2 MAINTENANCE

The Correction is kept under configuration control using the CVS and consists of:
- the build module BUILD_CORR
- One module for each s/w component.

4.2.4.3 DELIVERY

The Corrections deliveries are done through the CVS. Each delivery is identified by the BUILDxx CVS tag.

4.2.4.4 INSTALLATION

The installation procedure is specified in the Build Release document, included in the s/w delivery.

4.2.5 USAGE

The Data Correction Pipelines runs at each contact, once all the LV1 data have been produced.

4.3 GRID Quicklook Standard

4.3.1 DESCRIPTION

This is an automatic part of the GRID QLA, which is performed by the QLSTD pipeline. The QLSTD pipeline runs on predefined (relatively short) time intervals. The pipeline uses the same modules of the GRID Standard Analysis and Scientific Analysis to produce event files (files .flg and .evt), log files (.log). Also counts and exposure maps are produced.
The files produced in the GRID Automatic QLA are used as inputs for the Quick Look Scientific Analysis and for the Interactive Quick Look.

4.3.2 INTERNAL I/F

QLSTD Modules require:

- read access to the NAS Disks in order to read COR files
- write access to the NAS Disks in order to write the output files:
  - .log created by the LogGenerator module
  - .flg.index created by the Filter module
  - .evt.index, .evt created by the GridEvGen module.

4.3.3 EXTERNAL I/F

QLSTD products will be retrievable by authorized AGILE Team Members through WEB I/F provided by ASDC.

4.3.4 SW MANAGEMENT

4.3.4.1 RESPONSIBILITY

The Modules used in this sub-system are the same that constitute the GRID Standard Analysis and the GRID Scientific Analysis. Therefore their development and maintenance is in charge to the Agile Team (IASF Milano and IASF Bologna).
The ASDC is responsible for their integration into the QLSTD pipeline, as well as for the maintenance and operation of the pipeline.

4.3.4.2 MAINTENANCE

The QLSTD is kept under configuration control using the CVS and consists of the modules described in Section 4.5.

4.3.4.3 DELIVERY

See Section 4.5.4.3.

4.3.5 USAGE

This task is automatically performed by the QLSTD pipeline.

4.4 GRID Incremental Standard

4.4.1 DESCRIPTION

This is an other automatic part of the GRID QLA performed by the QLSCI pipeline. Similarly to the QLSTD pipeline it uses the same modules of the GRID Standard Analysis. The aim of the QLSCI pipeline is to perform an analysis on incrementally increasing time intervals.

4.4.2 INTERNAL I/F

QLSCI Modules require:

- read access to the NAS Disks in order to read COR files
- write access to the NAS Disks in order to write the output files:
  - .log created by the LogGenerator module
  - .flg.index created by the Filter module
  - .evt.index, .evt created by the GridEvGen module.

4.4.3 EXTERNAL I/F

QLSCI products will be retrievable by authorized AGILE Team Members through WEB I/F provided by ASDC.

4.4.4 SW MANAGEMENT

4.4.4.1 RESPONSIBILITY

The Modules used in this sub-system are the same that constitute the GRID Standard Analysis and the GRID Scientific Analysis. Therefore their development and maintenance is in charge to the Agile Team (IASF Milano and IASF Bologna).
The ASDC is responsible for their integration into the QLSCI pipeline, as well as for the maintenance and operation of the pipeline.

4.4.4.2 MAINTENANCE

The QLSCI is kept under configuration control using the CVS and consists of the modules described in Section 4.5.

4.4.4.3 DELIVERY

See Section 4.5.4.3.

4.4.5 USAGE

This task is automatically performed by the QLSCI pipeline.

4.5 GRID Standard Analysis

4.5.1 DESCRIPTION

The GRID Standard Analysis is required to produce Event files and Log files starting from the Corrected data. The bulk of the processing in this subsystem consists of the recognition of the patterns in the silicon tracker to classify the events, eliminate the unwanted background and reconstruct the arrival direction of the photons. The Log Generator produces log files containing all the information on instrument configuration modes, attitude, etc... which is required in the subsequent analysis.

4.5.2 INTERNAL I/F

GRID Standard Analysis Modules require:

- read access to the NAS Disks in order to read COR and INDEX files
- write access to the NAS Disks in order to write the output files:
  - .log created by the LogGenerator module
  - .flg.index created by the Filter module
  - .evt.index, .evt created by the GridEvGen module.

4.5.3 EXTERNAL I/F

The Grid Standard Analysis development and maintenance is in charge to the Agile Team (IASF Milano and IASF Bologna) at the level of the single Modules.
The ASDC is responsible for the integration of the Modules into the Standard Analysis pipeline and its maintenance and operation.

4.5.4 SW MANAGEMENT

4.5.4.1 RESPONSIBILITY

Development and maintenance of the GRID Standard Analysis Modules is in charge to the Agile Team (IASF Milano and IASF Bologna).
The ASDC is responsible for their integration into the QLSCI pipeline, as well as for the maintenance and operation of the pipeline.

4.5.4.2 MAINTENANCE

The GRID Standard Analysis is kept under configuration control using the CVS and consists of:

- the build module BUILD_GRID
- the Filter
- the LogGenerator
- the GridEvGen

4.5.4.3 DELIVERY

The GRID Standard Analysis deliveries are done through the CVS. Each delivery is identified by the ..BUILDxx CVS tag

4.5.5 USAGE

This task is automatically performed by the STD pipeline.

4.6 Payload Control (APC)

4.6.1 DESCRIPTION

The AGILE Payload Control (APC) is required to produce an automatic check on the satellite telemetry data. The SW tool is composed by three principal blocks:
1) a Perl pipeline devoted to the APC processing management and the warning/alert messages generation (e-mail and/or SMS);
2) a C routine devoted to the source packet extraction from the telemetry frames;
3) a set of IDL routines devoted to the parsing and calibration of the telemetry data and the monitoring of the engineering health status;
The IDL processing step is driven by a set of datacards describing the Bus and Payload telemetry structure and the check rules to be implemented.

4.6.2 INTERNAL I/F

APC require read access to the NAS Disks in order to read L0 files.

4.6.3 EXTERNAL I/F

APC requires access to the ASDC SMTP server in order to deliver to ASDC team and Agile Team the warning/alert messages (e-mail and/or SMS).

4.6.4 SW MANAGEMENT

4.6.4.1 RESPONSIBILITY

The APC development is in charge to the AGILE Team (IASF-Roma).

4.6.4.2 MAINTENANCE

The APC maintenance is in charge to the AGILE Team (IASF-Roma).

4.6.4.3 INSTALLATION

The APC installation is in charge to the AGILE Team (IASF-Roma).

4.7 Standard Performance Monitoring

4.7.1 DESCRIPTION

4.7.2 INTERNAL I/F

4.7.3 EXTERNAL I/F

4.7.4 SW MANAGEMENT

4.7.4.1 RESPONSIBILITY

4.7.4.2 MAINTENANCE

4.7.4.3 DELIVERY

4.7.4.4 INSTALLATION

4.7.5 USAGE

4.8 SA Std Pipeline

4.8.1 DESCRIPTION

4.8.2 INTERNAL I/F

4.8.3 EXTERNAL I/F

4.8.4 SW MANAGEMENT

4.8.4.1 RESPONSIBILITY

4.8.4.2 MAINTENANCE

4.8.4.3 DELIVERY

4.8.4.4 INSTALLATION

4.8.5 USAGE

4.9 BURST Pipeline

4.9.1 DESCRIPTION

4.9.2 INTERNAL I/F

4.9.3 EXTERNAL I/F

4.9.4 SW MANAGEMENT

4.9.4.1 RESPONSIBILITY

4.9.4.2 MAINTENANCE

4.9.4.3 DELIVERY

4.9.4.4 INSTALLATION

4.9.5 USAGE

5 ASDC INTERACTIVE ENVIRONMENT

5.1 GRID Interactive Quick Look Analysis

5.1.1 DESCRIPTION

The aim of this sub-system is to perform the Quick Look Analysis in interactive way in order to obtain a better sensitivity and derive scientific results adequate to the different specific cases. This analysis is based on the same modules that constitute the GRID Standard Analysis and the GRID Scientific Analysis. They are inserted into a pipeline (QLUSR) that can be configured by the user to change the different parameters used in each run.

5.1.2 INTERNAL I/F

5.1.3 EXTERNAL I/F

The GRID Interactive QLA is performed remotely by the Agile Team through a WEB based interface. This allows to select the data (time interval) of interest, modify the input parameters of the modules, launch the execution of the pipeline, and monitor its execution. It is also possible to retrieve the produced data.

5.1.4 SW MANAGEMENT

5.1.4.1 RESPONSIBILITY

The Modules used in this sub-system are the same that constitute the GRID Standard Analysis and the GRID Scientific Analysis. Therefore their development and maintenance is in charge to the Agile Team (IASF Milano and IASF Bologna).
The ASDC is responsible for their integration into the QLSCI pipeline, as well as for the maintenance and operation of the pipeline.

5.1.4.2 MAINTENANCE

The GRID Interactive QLA is kept under configuration control using the CVS and consists of the modules described in Section 4.5.

5.1.5 USAGE

The GRID Interactive QLA is performed remotely by the Agile Team through a WEB based interface.

6 ASDC – AGILE INSTITUTES DATA I/F

6.1 Interface Modes

6.1.1 FILE TRANSFER MODES

ASDC is in charge of archiving all the Telemetry files (L0 Files) and the Auxiliary files (AUX files) received from the Agile Operations and Control Centre (AOCC) located at Telespazio, Fucino.

At ASDC, these data are processed by various s/w subsystems, which generate and archive at ASDC other set of files (L1, L1 Cor, L2, …).
As required by the tasks to be carried out by the Agile Team, some of these files have to be copied to the Agile Team Scientific Institutes.
This leads to foresee the following file transfer modes (Figure 6-1):

- automatic mode, which is mainly reserved to engineering data to be copied every orbit, and to sample of scientific data to be copied every "n" orbit;
- on-request mode, which is mainly used for scientific data, to be retrieved on the basis of the period selected by the user.

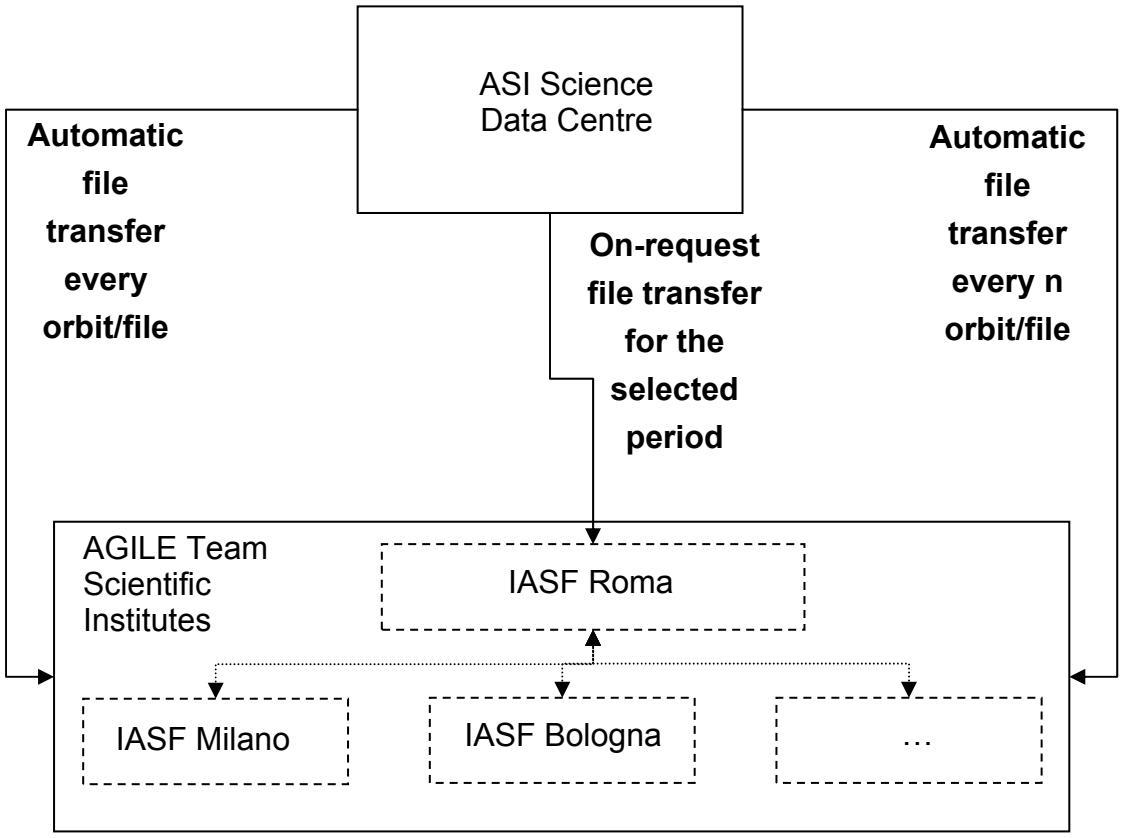

Figure 6-1 ASDC/Agile Institutes - File Transfer Modes

6.1.1.1 AUTOMATIC MODE

In this mode, the transfer is initiated by ASDC, which, acting as ftp Client, establishes an ftp connection to the ftp Server running at the Agile Team Institute.
Each file transfer operation is identified by:

- the "parameters" identifying the file (e.g.: TM, level L1, type 32, subtype 01);

- the frequency (e.g.: every orbit/file or one every *n* orbit/file);
- the IP of the ftp Client;
- the ftp user and password
- the ftp destination directory.

ASDC shall notify the completion of each file transfer by sending to the Client an empty file which name is given by adding the extension ".ok" to the name of the data file (e.g. PKP000526_0_33XY_000.lv1.gz.ok).

6.1.1.2 ON-DEMAND MODE

In this mode, the transfer is initiated by the Agile Team user, through a suitable WEB site provided by ASDC.
The access to this mode shall be limited to:
- the hosts which IP are authorized to access the WEB site;
- the users who are authorized to log into the WEB site.

6.2 ASDC to AGILE Remote Control (ARC)

6.2.1 DESCRIPTION

The AGILE Remote Control (ARC) is required to generate and archive the on-board Payload scientific configurations. The general AGILE scientific configuration is defined by all the parameters needed to determine the telecommands TC33S1-TC33S20 with MID='DATA RAM' and MID='DATA EEPROM' and all the LUTs used by the on-board scientific processing (see AD[6]).
The ARC SW is composed by:
1) an MySql database containing all the generated configurations;
2) a Web application (written in PhP) devoted to MySql management and providing the user interface;
3) a C library used to import the telemetry and parameters definition from the Laben database format to the MySql format;
4) a C library used to implement a check on the generated ARC configurations
The TCs and LUTs generated by ARC are used during the AGILE contingency management.

6.2.2 RESPONSIBILITY

The ARC development and maintenance is in charge to the AGILE Team (IASF-Roma).

6.2.3 EXTERNAL I/F

The ARC server produces TC and LUT output data to be used during the contingency operations
The output file formats are described hereafter.

Telecomand format:
The TC files generated by ARC are named in order to identify the type, sub-type, memory and sequence count of the requested TC and will contain the parameter PREF and the engineering values of all the variable parameters foreseen by the specific TC layout.

LUT format:
A primary Header Data Unit (HDU) with an extension composes the file in FITS format used for the Payload Look-up Tables (LUTs) transfer.
The primary header provides, in addition to the mandatory keywords, all information needed to identify the on-board LUT and to maintain the patch under configuration control.
The appropriate LUT start address and length corresponding to the primary header identification are provided by the IPL User Manual.
The extension to the HDU is used to transfer the look-up table content. The layout of the extension depends on the address/data definition of the specific LUT (see AD[6]).

6.3 ASDC to Payload Control (APC)

6.3.1 DESCRIPTION

This is the same task which runs at ASDC (see 4.6) allowing the Agile Team to timely investigate any warning/alert messages (e-mail and/or SMS) received from the APC running at ASDC.
It requires access to the relevant L0 files.

6.4 ASDC to Health Monitoring

6.4.1 DESCRIPTION

The Health Monitoring task to be run at the Scientific Institutes requires automatic and systematic transfer from ASDC to Agile Team Institutes of selected AGILE data:

i. All L0 TM Packets (S/C+BUS) except 39.1 and 39.8 (every orbit)

ii. All L1 Engineering data Type.Subtypes listed below (every orbit)

iii. One complete L0 VC1 file every n orbit

iv. A selection of Auxiliary Files.

Payload TM

With reference to Table 1 below (see doc "Payload TM & TC I/F ICD", AGILE-LAB-ID-004):

- L1 Files: All Subtypes of the TM Packets having the Packet Type: 32, 33, 34, 35, 36, 37, 38, 40
- L1 Files: TM Packet Type 39 Subtype: 2, 3, 4, 9, 10, 11, 13, 14, 15, 16, 17, 18.

BUS TM

- L1 Files: All. For the time being only the L1 file having Packet Type 01 Subtype 01 is generated.

6.5 ASDC to Performance Monitoring

6.5.1 DESCRIPTION

The tasks to be run at the Scientific Institutes in order to monitor the performances of the Payload complement require automatic and systematic transfer from ASDC to Agile Team Institutes of selected AGILE data:

i. All L1 Engineering data Type.Subtypes listed below (every orbit)

ii. A selection of Auxiliary Files.

Payload TM

With reference to Table 1 below (see doc "Payload TM & TC I/F ICD", AGILE-LAB-ID-004):

- L1 Files: All Subtypes of the TM Packets having the Packet Type: 32, 33, 34, 35, 36, 37, 38, 40
- L1 Files: TM Packet Type 39 (including SA) Subtype: 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14, 15, 16, 17, 18.
- TBD Sample of TM 39.01 and 39.08.

BUS TM

- L1 Files: All. For the time being only the L1 file having Packet Type 01 Subtype 01 is generated.

6.6 ASDC to SA Refined Analysis

6.6.1 DESCRIPTION

TBD

6.7 ASDC to AT Data Analysis Projects

6.7.1 DESCRIPTION

TBW

Packet Type	Type Function	Packet Sub-Type	Sub-Type Function
32	*Periodic TM Reports*	1	Housekeeping Report
33	*Telecommand Verification TM Reports*	1	Successful Command Acceptance Report
		2	Unsuccessful Command Acceptance Report
		3	Successful Command Start Execution Report
		4	Unsuccessful Command Start Execution Report
		7	Successful Command Execution Report
		8	Unsuccessful Command Execution Report
34	*Event TM Reports*	1	Boot Report
35	*Exception TM Reports*	1	Buffer Saturation Report
		2	Buffer De-saturation Report
		3	Latch-up Report
		4	P/L Sub-Systems Link Anomaly Report
		5	Software Error Report
		6	Monitoring Report
36	*P/L Configuration TM Reports*	1	General P/L Configuration Report
37	*Memory Maintenance TM Reports*	1	Memory Dump Report
		2	Memory Checksum Report
38	*Telemetry Management TM Reports*	1	Active Packets Generation Report
39	*Science Data TM Reports*	1	GRID Event Report
		2	GRID Calibration Report
		3	ST Pedestal Report
		4	ST Electrical Calibration Report
		5	SA Event Report
		6	SA Imaging Report
		7	SA Burst Imaging Report
		8	MCAL Burst Event Report
		9	MCAL Burst Calibration Report
		10	MCAL Electrical Calibration Report
		11	Burst Fast Ratemeters Report
		12	Burst Alert
		13	Scientific Ratemeters Report
		14	Star Sensor Data Report
		15	Star Sensor for S/C ACS Report
		16	GPS Data Report
		17	Zombie Report
		18	AC Calibration Report
40	*GPS and SS Management TM Reports*	1	GPS Management Data Report
		2	SS Management Data Report
		3	Star Sensor Measure and Reference Stars

Table 1 Applicable PDHU Telemetry Packets Types and Subtypes