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TM Pre-Processing System ICD**

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1 INTRODUCTION

1.1 Scope and Purpose of the Document

The Pre-Processing System (PPS) shall be run at ASDC in order to:

- archive and process the AGILE Level 0 (L0) Telemetry and Auxiliary files uploaded by the AGILE Operation & Control Center (AOCC) of the Ground Segment (GS)
- generate and archive the Level 1 (L1) files for the ASDC Pipeline Processing System.

The PPS shall consist of two independent components:

- the TM Pre-Processing System (TM PPS), devoted to the handling of the L0 TM files
- the AUX Pre-Processing System (AUX PPS), devoted to the handling of the L0 AUX files.

Section from 3 to 6 present the overall scenario and general aspects which are common to both the TM PPS and the AUX PPS.

Section 7 presents the interface details which are specific to the TM PPS.

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] A.Bulgarelli, F.Gianotti, M.Trifoglio, AGILE-ITE-SR-007, "AGILE Science Console and Pre-Processing Software Requirement Document", IASF Sez. di Bologna Report 378/03

- AD [2] M.Trifoglio, A.Bulgarelli, F.Gianotti, AGILE-ITE-SR-009, "AGILE Data Center Pre-Processing System (APS) Requirements", IASF Sez. di Bologna Report 383/03.
- AD [3] Ground segment requirement document, AGRTI-RQ-TPZ-001
- AD [4] 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

2.2 Reference Documents

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

- RD [1] SNV047-PRO-002 Ed. 2 Rev. 1 – 21/03/03 Programma Agile – Proposta per la realizzazione del Segmento di Terra ed il Controllo di Missione per due anni : Proposta Tecnica-Manageriale.
- RD [2] Gianotti F., Trifoglio M., DISCoS – a detector-independent software for the on-ground testing and calibration of scientific payloads using the ESA Packet Telemetry and Telecommands Standards, ADASS X Conference Proceedings, Boston 12-15 November 2000
- RD [3] A.Bulgarelli, F.Gianotti, M.Trifoglio, AGILE-ITE-SD-002, PacketLib Detailed Design Report, AGILE-ITE-SD-002, IASF Sez. di Bologna Report 350/02
- RD [4] A.Bulgarelli, F.Gianotti, M.Trifoglio, PacketLib Reference Manual, INAF/IASF Sez. di Bologna Report 411/05
- RD [5] A.Bulgarelli, F.Gianotti, M.Trifoglio, AGILE-ITE-SD-001, PacketLib Programmer's Guide, AGILE-ITE-SD-001, INAF/IASF Sez. di Bologna Report 410/05
- RD [6] A.Bulgarelli, F.Gianotti, M.Trifoglio, AGILE-ITE-SD-001, ProcessorLib Programmer's Guide, AGILE-ITE-SD-001, IASF Sez. di Bologna Report 349/02
- RD [7] A.Bulgarelli, F.Gianotti, M.Trifoglio, AGILE-ITE-SD-003 ProcessorLib Detailed Design Report, AGILE-ITE-SD-003, IASF Sez. di Bologna Report 351/02,
- RD [8] Definition of the Flexible Image Transport System (FITS), March 29, 1999, NOST 100-2.0, NASA/Science Office of Standards and Technology

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 OVERALL SCENARIO

In order to correspond to the fault tolerant mechanism implemented by the GS, the ASDC shall run the PPS on two identical and independent computers:

- the PPS Prime Computer
- the PPS Backup Computer.

Both computers shall run autonomously, so that the PPS software running on each system shall be unaffected by failure of the other one.

On each computer, the PPS shall consist of two independent components:

- the TM Pre-Processing System (TM PPS), devoted to the handling of the L0 TM files
- the AUX Pre-Processing System (AUX PPS), devoted to the handling of the L0 AUX files.

As sketched in Figure 3-1, these components shall provide an independent Pipeline which shall:

- acquire the L0 file from each own ftp Area
- process and archive the L0 file and the corresponding output files in the ASDC File Server computer.

In particular, the TM PPS Pipeline shall foresee a local temporary archive where all the L0 and L1 files shall be saved and operated by means of a local Data Base (TMPPS DB).

A similar DB (TMASDC DB) shall be installed on the ASDC File Server computer in order to coordinate and keep record of all the archiving operations performed remotely on the Consolidated Archive by the TM PPS running on the two PPS computer.

The TMASDC DB shall be exploited in order to implement a first-come, first-served service policy which shall allow write access to the Consolidated Archive to only one of the two PPS computer.

On each PPS computer, the TM PPS shall foresee the following operating modalities:

- *On-line Processing Mode*, where the Pre-Processing Pipeline shall be fed with the GS files as soon as they are available in the TM PPS ftp area
- *Off-line Processing Mode*, which shall be used in the following cases:
 - OP.1 all the TM L0 files related to a given set of Contact Numbers need to be reprocessed because the previous processing terminated with errors due to corrupted L0 files.

OP.2 all the TM L0 files related to a given set of Contact Numbers need to be reprocessed after that the nominal conditions have been restored after system failures.

OP.3 all the TM L0 files related to a given set of Contact Numbers need to be reprocessed with a different version of the Pre-Processing Pipeline.

In case OP.1 both the previous L0 file and L1 files (if any) shall be replaced in both the Temporary Archive and the Consolidated Archive. The new L0 file shall be retrieved from somewhere (i.e.: Temporary Archive, Removable Media, ...).

In cases OP.2 and OP.3, the original L0 files shall be retrieved from the Consolidated Archive and copied to the Temporary Archive, while the L1 files shall be replaced in both the Temporary Archive and the Consolidated Archive.

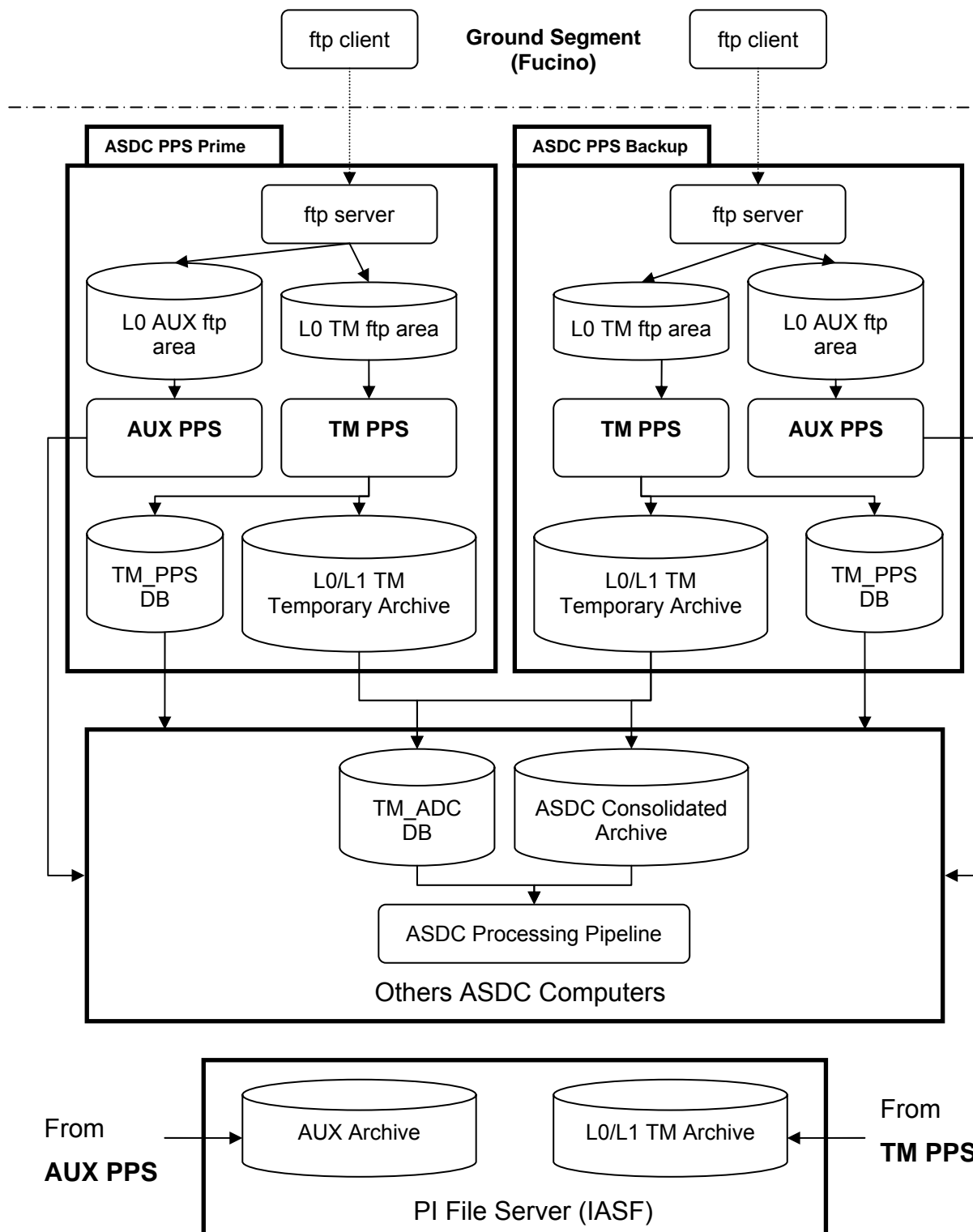


Figure 3-1 PPS Acquisition and Archiving data flow

4 PPS SYSTEM CONFIGURATION

4.1 LAN

Each PPS computer shall be equipped with two LAN I/F:

- one I/F shall be configured with a private IP pertaining to the network for the data exchange with the Ground Segment at Fucino.
- one I/F shall be configured with a public IP pertaining to the public network for the transfer of the L0 and L1 files to the file server computer of the Agile Team located at PI premises.

4.2 User groups

The groups defined on each PPS computer shall include:

- the “*ftp*” group, with assigned the Suse default number “49”;
- the “*iasfbo*” group, with assigned the number “700”, for the TM Pre-Processing s/w;
- the “*asdc*” (TBC) group for the AUX Pre-Processing s/w.

4.3 Ftp users

On each PPS computer, the following ftp users shall be defined for the data exchange with the GS:

- *tm_ftp:ftp*
- *aux_ftp:ftp*

Each ftp user shall have his own home directory defined with *chmod 770*, in order to provide read/write access to the Pre-Processing users defined in 4.4.

These ftp users shall provide under their home directory the ftp areas shown in Figure 4-1.

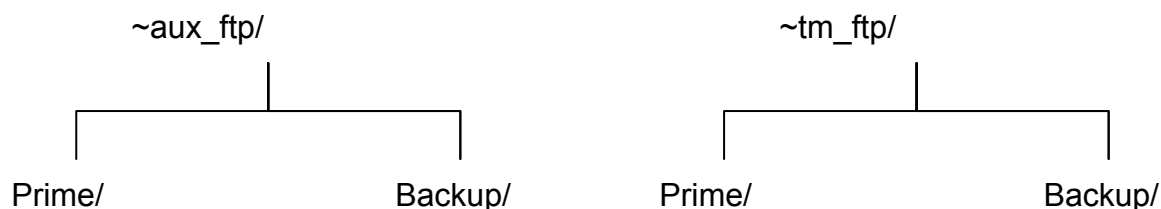


Figure 4-1 Directory tree of the ftp areas defined in each PPS computer

4.4 Pre-Processing users

On each PPS computer, the following users shall be defined for the TM Pre-Processing software:

- *gtb:iasfbo* for s/w development
- *tmpps:iasfbo* for production environment

Similar users shall be defined for the AUX Pre-Processing software.

In order to provide them the access to the ftp areas defined in 4.3, these users shall belong to the ftp group.

4.5 Software management

4.5.1 Development System Environment

At the time of writing the PPS software is being developed with the following system software configurations.

4.5.1.1 TMPPS

- Linux/SuSE 9.2
- gcc 3.3.4
- Mysql 4.0.21 MAX Server
- Mysql 4.0.21 MAX Client
- Php 4.3.8 with Register global false
- Apache 2.0.48
- Perl 5.8.1

4.5.1.2 AUX PPS

- Linux/SuSE 9.2
- gcc 3.3.3.
- Mysql 4.1.10A MAX Client
- Php 4.3.10 with Register global false
- Apache 2.0
- Perl 5.8

4.5.2 Target System Environment

The PPS computers shall provide the following system software configuration:

- Linux/SuSE 9 Enterprise (TBC)
- Mysql 4.x MAX Client
- Php 4.x with Register global false

- Apache 2.0
- gcc 3.3.x.
- Perl 5.x
- TBD

4.5.3 CVS Repository

The two PPS computers shall host:

- the mirror of the CVS repository which has been established at INAF/IASF Bologna for the development and maintenance of the TM PPS application software.
- the mirror of the archive area located at INAF/IASF Bologna where are available the tar ball of the Open Source external libraries required by the TM PPS.

4.5.4 Software installation

The Open Source external libraries shall be installed under the directory tree `/usr/local_gtb/` from where they shall be accessible to all the Pre-Processing users.

The TM PPS application software shall be installed under the Pre-Processing user directory by means of the Build software module to be checked out from the CVS repository by specifying the CVS tag corresponding to the TM PPS Build Version Number.

The Build software module includes the Makefile file which shall be invoked as follows:

- `make checkout` to check out from the CVS repository under the `$HOME/Project` directory all the required software modules, by specifying for each module the CVS tag required for that Build Version
- `make install` to compile under `$HOME/Project` and install under `$HOME/local/bin` all the required software modules

5 GS / PPS DATA FLOW

Both PPS computers shall receive from the Ground Segment (GS) Data Server one copy of the L0 TM files and L0 Auxiliary files.

The transfer of all these files from the GS to the PPS computers shall be controlled by the GS which shall act as ftp Client through a redundant data communication line (one Prime at 512 Kbps and one Backup at 512 Kbps).

The GS shall notify the completion of each file transfer by creating in the same directory an empty file with suitable name (L0 synchronization file).

The GS shall keep two lists of L0 files to be transferred:

- the list for the TM PPS
- the list for the AUX PPS

The list for the TM PPS shall include for each satellite contact:

- the VC0 TM file
- the VC1 TM file
- other TBD

The list for the AUX PPS shall include all the Auxiliary files defined in AD [4].

The files of the TM PPS list shall be uploaded to the *tm_ftp* user.

The files of the AUX PPS list shall be uploaded to the *aux_ftp* user.

In nominal conditions, the files of the TM PPS list and the AUX list shall be transferred by the GS to the ftp area of the designated ftp user as follows:

- the first copy shall be uploaded under the *Prime* subdirectory of the ftp user of the PPS Prime computer
- the second copy shall be uploaded under the *Backup* subdirectory of the ftp user of the PPS Backup computer.

In case the PPS Prime computer is not available, its files shall be transferred into the *Prime* subdirectory of the designated ftp user of the PPS Backup computer.

In case the PPS Backup computer is not available, its files shall be transferred into the *Backup* subdirectory of the designated ftp user of the PPS Backup computer.

6 ASDC / IASF DATA FLOW

Suitable mechanisms shall be implemented in order to copy on the Agile Team computer, located at the AGILE PI premises, the following files :

- a) all the L0 TM files and the related L1 files
- b) all the L0 AUX files and the related L1 files.

The interfaces related to the former set of files (point a) are presented in 7.8. Similar interfaces should be foreseen for the AUX files.

7 TM PPS INTERFACES

7.1 TM PSS Ftp Area

In this area the GS shall upload the L0 files and L0 synchronisation files to be processed by the TM PPS.

7.1.1 ENVIRONMENT VARIABLES

The TM PPS software shall refer to the following shell environment variable:

- **\$TM_FTP = :** “~tm_ftp”. Root directory of the TM PPS ftp Area.

7.1.2 DIRECTORIES

The TM PPS ftp Area shall have the structure shown in Figure 7-1.

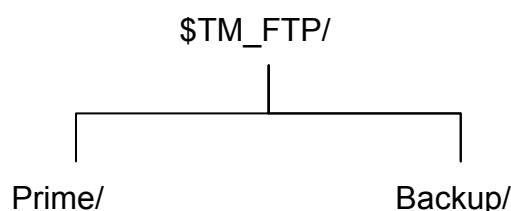


Figure 7-1 Directory tree of the TM PPS ftp Area

The files shall be uploaded to either the Prime or the Backup subdirectory, on the basis of the policy presented in 5.

7.1.3 L0 FILES

The L0 TM files uploaded by the GS shall have the following file naming:

VC-xx.P-nnnnn.pkt

where:

xx=Virtual Channel ID (00 o 01)

nnnnn = Contact Number

7.1.4 L0 SYNCH FILES

For each L0 file uploaded, the GS shall create in the same directory an empty file (L0 synch file) which name is constructed by adding the trailer ".ok" to the L0 file name, i.e.:

VC-xx.P-nnnnn.pkt.ok

7.2 Temporary Archive

The Temporary Archive shall provide the working area were the PPS shall:

- move the L0 input file from the ftp Area
- save the L1 and the Log output file creating by the pre-processing of the L0 file.

7.2.1 ENVIRONMENT VARIABLES

For the Temporary Archive, the TM PPS software shall refer to the following shell environment variable:

- **\$TM_TMP_L0** : root directory for the L0 files
- **\$TM_TMP_L1**: root directory for the L1 files
- **\$TM_TMP_LG**: root directory for the Log files

7.2.2 DIRECTORIES

The Temporary Archive directory structure is shown in Figure 7-2.

For the L0 and L1 files, one subdirectory “nnnnnn” is devoted to each Contact Number. The log files are saved in same directory.

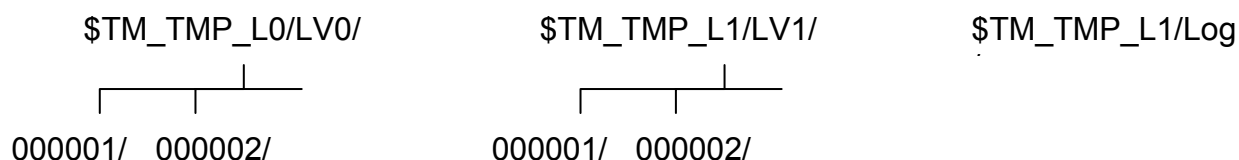


Figure 7-2 Temporary Archive directory tree

7.2.3 L0 FILES

While coping the L0 files from the ftp Area, the TM PPS shall rename them by changing the contact number from 5 to 6 digits, i.e.:

from **VC-xx.P-nnnnn.pkt** to **VC-xx.P-nnnnnn.pkt**

7.2.4 L1 FILES

The L1 files created by the TM PPS shall have the following file naming:

TTTnnnnnn_C_PPSS_XXX.lv1

where:

<i>TTT</i>	PKP for the files related to the Payload TM PKS for the files related to the Bus TM (if any)
<i>nnnnnn</i>	Contact Number derived from the name of corresponding L0 file
<i>C</i>	Virtual Channel number derived from the name of corresponding L0 file, i.e.: 0 for VC0, 1 for VC1
<i>PP</i>	packet type
<i>SS</i>	packet subtype
<i>XXX</i>	file counter, which shall be reset to “000” for each L0 file to be processed.

In most cases, the TM PPS processing of the TM packets contained in the input L0 file and having a given *PP.SS* shall create only one L1 file.

In some cases (e.g. for the TM 39.03, where a new file shall be created for each Pedestal Observation contained in the L0 file) this counter shall be incremented to distinguish the different files created by the TM PPS processing.

7.2.5 LOG FILES

For each L0 file which has been processed, the TM PPS shall create in the \$TM_TMP_L1/Log directory the log file having the same L0 file naming, but with extension “log” instead of “pkt”, i.e.:

VC-xx.P-nnnnnn.log

7.3 Consolidated Archive

This is the disc area where the PPS shall archive the L0 and the L1 files for the ASDC Processing Pipeline.

In the nominal case, this disc area shall be located on the ASDC file server computer and accessible by the PPS computer via NFS.

7.3.1 ENVIRONMENT VARIABLES

For the Consolidated Archive, the TM PPS software shall refer to the following shell environment variable:

- **\$TM_CON_L0** : root directory for the L0 files
- **\$TM_CON_L1**: root directory for the L1 files
- **\$TM_CON_LG**: root directory for the Log files

7.3.2 DIRECTORIES

The Consolidated directory structure is shown in Figure 7-3.

For the L0 and L1 files, one subdirectory “nnnnn/” is devoted to each Contact Number. The log files are saved in same directory.

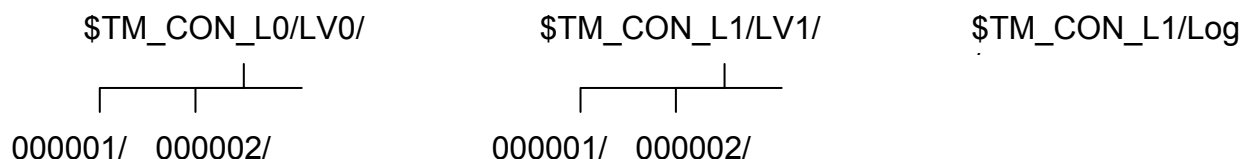


Figure 7-3 Consolidated Archive directory trees

7.3.3 L0 FILES

Same file naming of the Temporary Archive.

7.3.4 L1 FILES

Same file naming of the Temporary Archive.

7.3.5 LOG FILES

Same file naming of the Temporary Archive.

7.4 TM Synch Area

In this disc area the PPS shall create the synchronisation files which shall notify to the ASDC Processing Pipeline that new L1 files are available in the Consolidated Archive.

In the nominal case, this disc area shall be located on the ASDC file server computer and accessible by the PPS computer via NFS.

7.4.1 ENVIRONMENT VARIABLES

For the TM Synch Area, the TM PPS software shall refer to the following shell environment variable:

- **\$TM_SYN:** complete path of the directory for the TM Synch files.

7.4.2 DIRECTORIES

The \$TM_SYN directory shall not have any subdirectory.

7.4.3 L1 SYNCH FILES

The TM PPS shall notify the completion of the processing of a given L0 file by creating in the in \$TM_SYN a suitable empty file having the name:

VCx.nnnnnn.vvv.zz

where:

x 0 for Virtual Channel 0

 1 for Virtual Channel 1

nnnnnn Contact Number,

vvv Version Number contained in the FITS Keyword BUILDVER of all the L1 files created by the TM PPS.

e.g.: vvv=016 if BUILDVER = BUILD16

zz "ok" the processing of the L0 file has been completed successfully

 "wr" one or more CRC errors detected

 "er" one or more TM packet has not been processed

7.4.4 CNT SYNCH FILES

The TM PPS shall notify the completion of the processing of a both the VC0 L0 and VC1 L0 files related to a given contact by creating in the in \$TM_SYN a suitable empty file having the name:

CNT.nnnnnn.vvv.zz

where:

nnnnnn Contact Number,

- vvv** Version Number contained in the FITS Keyword BUILDVER of all the L1 files created by the TM PPS.
e.g.: vvv=016 if BUILDVER = BUILD16
- zz** “ok” the processing of the L0 file has been completed successfully
“wrn” one or more CRC errors detected
“err” one or more TM packet has not been processed

7.5 TM PID Area

In this disc area the TM PPS shall create the files which shall provide the status of its main tasks.

In the nominal case, this disc area shall be located on the PPS computer and accessible by the ASDC Pipeline computer via NFS.

7.5.1 ENVIRONMENT VARIABLES

For the TM PID Area, the TM PPS software shall refer to the following shell environment variable:

- **\$TM_PID:** complete path of the directory for the TM PPS PID files.

7.5.2 DIRECTORIES

The \$TM_PID directory shall not have any subdirectory.

7.5.3 L1 SYNCH FILES

- **a2b_ccoe_scoe_flock.tmp** ASCII file containing the PID of the DISCOS Provider. This file shall be created every time one L0 file shall be submitted to the pre-processing task. This file shall be removed when the pre-processing is completed.

7.6 Scratch Areas

These areas shall host the L0 and L1 files to be deleted.

7.6.1 ENVIRONMENT VARIABLES

The TM PPS software shall refer to the following shell environment variables:

- **\$TM_SCR_FTP :** complete path of the scratch area where to move synch files from the ftp Area
- **\$TM_SCR_TMP:** complete path of the scratch area where to move old Temporary Archive files

- **\$TM_SCR_CON:** complete path of the scratch area where to move old Consolidated Archive files

7.6.2 DIRECTORIES

The above scratch directory shall not have any subdirectory, i.e. the files shall be saved irrespectively of the Contact Period.

7.7 Data Bases

The TM PPS shall exploit the following MySQL Relational Databases:

- TM_PPS DB which shall be installed on each PPS Computer
- TM_ADC DB which shall be installed on the ASDC File Server computer.

7.7.1 TM_PPS DB

The TM_PPS DB (Figure 7-4)shall keep record of the archiving and processing operations performed on the PPS computer on each L0, L1 and Log files pertaining to a given contact.

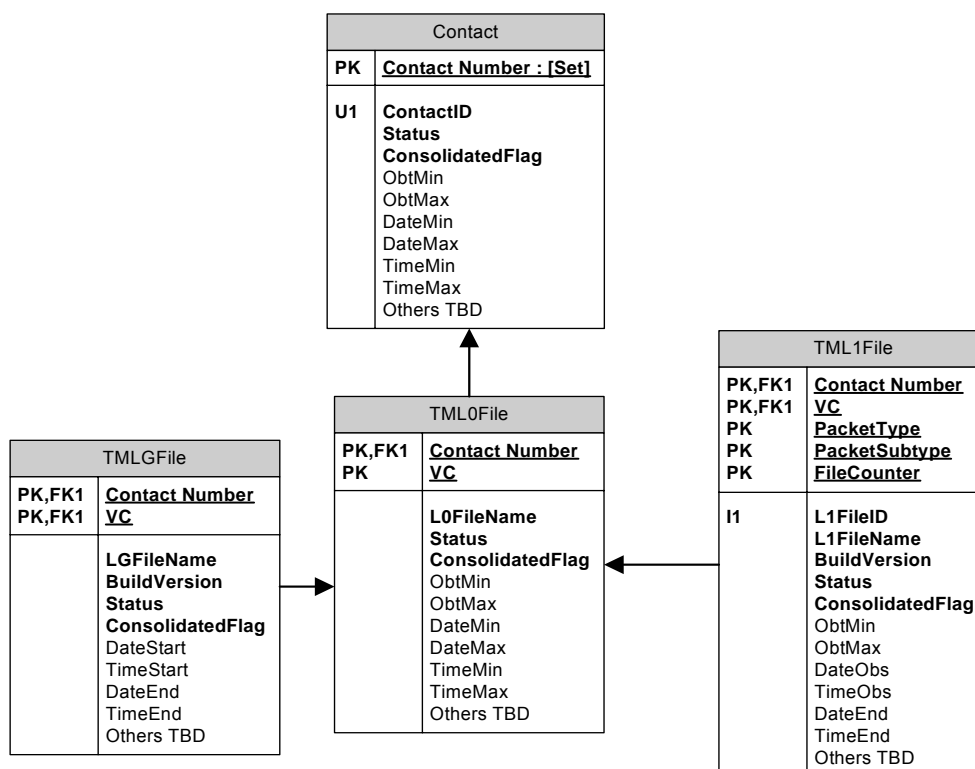


Figure 7-4 Schema of the TMPPS Data Base

The DB shall be populated by the PPS Pipeline, which shall:

- add new entries for each new L0 file which has been uploaded by the GS and for each L1 and Log file created by processing the L0 file;
- update the entry fields related to the processing status (*Status* field) and the archiving in the Consolidated Archive (*Consolidated Flag*) of each L0, L1 and LG file.

7.7.1.1 CONTACT TABLE

This table shall have one entry for each synch file uploaded by the GS that the TM PPS has detected in the ftp Area and has moved in the scratch area.

This table shall be created with the following SQL commands:

TBW

7.7.1.2 L0FILE TABLE

This table shall have one entry for each L0 file which that the TM PPS has moved from the ftp Area to the Temporary Archive, provided that its satellite contact has got one entry in the Contact Table.

This table shall be created with the following SQL commands:

TBW

7.7.1.3 LGFILE TABLE

This table shall have one entry for each Log file that the TM PPS has created in the Temporary Archive by processing one L0 file.

This table shall be created with the following SQL commands:

TBW

7.7.1.4 L1FILE TABLE

This table shall have one entry for each L1 file that the TM PPS has created in the Temporary Archive by processing one L0 file.

This table shall be created with the following SQL commands:

TBW

7.7.2 TMADC DB

On the ASDC File Server computer this DB shall coordinate and keep record of the archiving operations performed on the Consolidated Archive by the PPS computers.

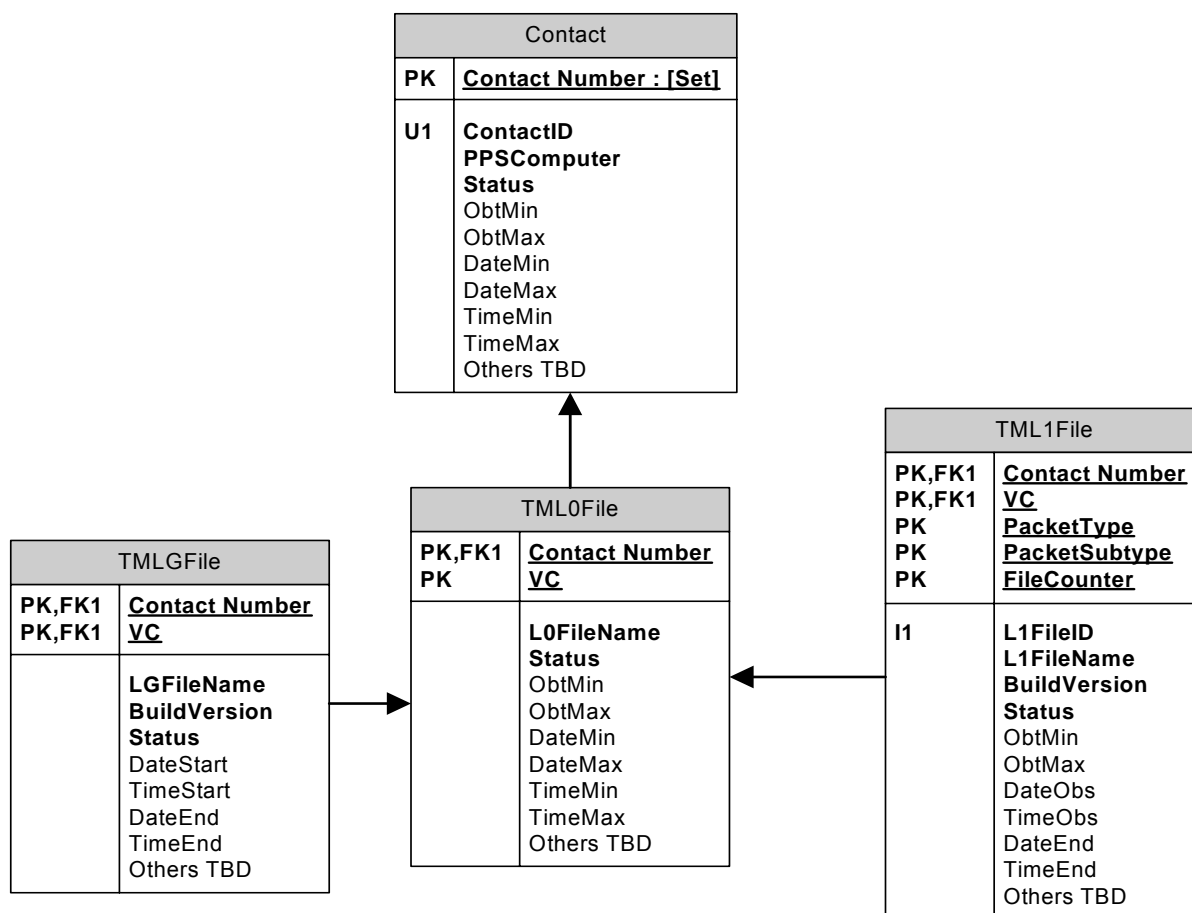


Figure 7-5 Schema of the TM ADC Data Base

The PPSCComputer field in the Contact Table shall contain the ID of the PPS computer which has obtained the permission for writing in the Consolidated Archive the files pertaining to a given contact.

7.7.2.1 CONTACT TABLE

This table shall have one entry for each Contact Period having at least one L0 file copied from the Temporary Archive to the Consolidated Archive.

This table shall be created with the following SQL commands:

TBW

7.7.2.2 L0FILE TABLE

This table shall have one entry for each L0 file copied from the Temporary Archive to the Consolidated Archive.

This table shall be created with the following SQL commands:

TBW

7.7.2.3 L1FILE TABLE

This table shall have one entry for each L1 file copied from the Temporary Archive to the Consolidated Archive.

This table shall be created with the following SQL commands:

TBW

7.7.2.4 LGFILE TABLE

This table shall have one entry for each Log file copied from the Temporary Archive to the Consolidated Archive.

This table shall be created with the following SQL commands:

TBW

7.8 PPS / IASF Interfaces

7.8.1 L0 FILE TRANSFER

TBW

7.8.2 L1 TM FILE TRANSFER

TBW.