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ESO Archive Services

Nathalie Rossat[1], Nausicaa Delmotte[1], Nathalie Fourniol[1],
Benoit Pirenne[1] and Adam Dobrzycki[1]

Abstract. The ESO/ST-ECF Science Archive Facility (SAF) is a joint collaboration of the European Southern Observatory (ESO) and the Hubble Space Telescope-European Coordinating Facility (ST-ECF). The archive provides access to data from both the Hubble Space Telescope (HST) and the European Southern Observatory (ESO).

The ESO Science Archive offers a number of on-line information services relevant to ESO users and to the community at large. In this paper, we will go through the different steps that enable a user to retrieve raw and processed data, from the query form to the actual processing. The concept of "Header On The Fly (HOTF)" that "repairs" possibly wrong data headers with meta-data from a database is also presented, together with the fact that calibrated data from ESO instruments will shortly be made available.

The emphasis in this poster will be on how the meta-data describing each ESO observation is kept in a relational database in instrument specific tables, and how this information is used to correct data upon distribution. The avenues for making ESO science products available to the Virtual Observatory (VO)[1] will also be explored.

1. Introduction

The European Southern Observatory (ESO) overseas two major observatories with state–of–the–art observing facilities located on Paranal and La Silla, Chile. Those observatories produce huge amounts of data which are stored in the ESO Archive. This paper describes the different on-line services that are provided to the ESO users and to the astronomical community at large, from proposal information to the distribution of data.

2. Data Distribution System

For about 13 years, ESO and HST archive data have been distributed to the astronomical community by the ESO Science Archive Facility. Requests of public

[1]ESO, European Southern Observatory, Karl-Schwarzschild-Str. 2,
D-85748 Garching bei München, Germany

[1]`http://www.euro-vo.org`

data can be submitted through the web (see Sect. 3.) and are serviced using *Request Handler*. It is a set of software entities that processes asynchronous user requests for data stored on archive storage media. Request handling can be decomposed into a number of steps :

- Submission of requests by users.
- Retrieval of the files from their archive support media to temporary data area identified by a request number. The currently supported archive data systems include CDs/DVDs, offline or in jukeboxes, the Next Generation Archive System (NGAS) and HTTP file access.
- Optionally, execution of a number of transformations on the files retrieved from storage.
- Sending a formatted message to the requestor notifying him/her of the service completion.

The Request Handler uses a database management system to continuously keep its status up-to-date. The core control database has about 5 different tables, and few more tables are need for the management of. The disk space, user and proprietary right management uses a few more. Database transaction security controls the parallelism of the task.

2.1. Submission of the Requests

Before retrieving data, one must register as a user under the menu "User On-Line Registration" of the main webpage of the SAF[2]. A complete set of information (like postal addresses, telephone number and password) is desiderable in case media have to be sent to the user. At present we have 3585 users of the Archive. Once the registration is done, the user can request a collection of data from the Archive by providing his/her unique user_id and password.

The submission consists of entering the request, constituted in a body and a header, in some database tables. The body contains a selection of one or more data products from the ones available in the Archive. The header contains the user identification (user_id), together with site/archive specific options (on-the-fly recalibration, write to DVD, etc).

Once a request is submitted, it is handled by the first of the three main asynchronous components constituting the Request Handler: the File Retrieval.

2.2. File Retrieval (RH_GET)

Once entered in the database, the request can be processed. Its availability is "discovered" by a program called RH_GET which periodically looks up the database tables for files to be retrieved. In the case where all the data is on-line (NGAS, HTTP) or quasi on-line (DVDs in jukeboxes) or off-line, in which case the operator is prompted to mount the relevant volume in a suitable drive, the procedure can run unattended.

Once files are available for retrieval, the RH_GET program takes them one by one and tries to either mount the medium on which they are to be visible in an available reader (jukebox in case of DVDs), or to copy them directly from

[2] `http://archive.eso.org`

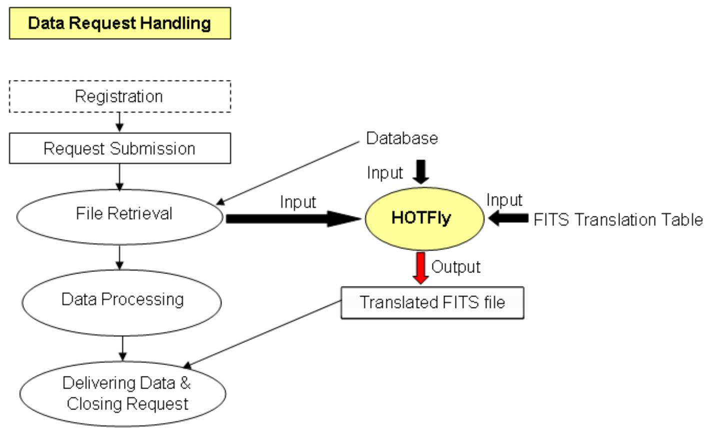

Figure 1. ESO Archive Data retrieval

hard disks (NGAS) or from other machines on a remote site (HTTP). The status of the data changes and data are ready to be processed.

2.3. Data Processing (RH_PROC and Header On The Fly)

Similarly to RH_GET, the program RH_PROC will periodically review the database queue for files/requests ready to be processed. Processing can be either a simple decompression, a sophisticated on-the-fly re-calibration or on-the-fly reconstruction of headers. A FITS file is composed of a header, containing observation meta-data, and a data part. Most important keywords from the FITS file header are stored in the relational database to keep track of the information related to the observation. The values of keywords stored in the database are sometimes updated, following the information obtained from the ESO Quality Control scientists or from the personnel from the observatories in Chile. The user may request either raw files, as observed at the telescope, or files updated with the most recent information. This is accomplished with the help of a tool called HOTFly (Headers On The Fly). This tool takes the original FITS file, searches for updates in the `observations` database, then generates a translated or corrected file on-the-fly and delivers it to the user.

The corrections are always applied to the keywords inside the header of the FITS file. The corrected values are stored in the database, which shall overwrite the erroneous ones in the original headers. In that sense was implemented a Data Base FITS Update and Correction Utility (DBFUCU). DBFUCU takes as input a configuration file, which is the main information source for carrying out the corrections from the Database to the original fits file.

A schematic view of the process is given in Fig. 1.

HOTFly can be used whenever ESO needs to distribute data to the users. HOTFly can be applied in two differents ways: either through the web when the user wish to display the header of a file he selected, or by the Request Handler which retrieves files from the Archive when the user submits a request.

Once the files have been processed, their status change again together with the request status in the database and this is the signal for the Request Handler that the request is ready to be closed.

2.4. Request Closure (RH_CLOSE)

Once all pending files in the service queue have been successfully retrieved from their storage media and copied to the staging areas, and once all retrieved files have successfully undergone the various possible processing steps for a given request (which means the request and its files have the adequate status in the database), a request is elligible for closure.

Like for RH_GET and RH_PROC, the RH_CLOSE procedure periodically looks up the database for any request statisfying the above conditions. If such request is found, RH_CLOSE sends an acknowledgment message to the user. It updates the request status in the database to the final status, indicating that the request is completed and set the completion date to present.

3. User Web Interfaces to the ESO Archive

Requesting ESO Archive data is done through on-line query forms based on Web to database Interface written in Perl. This toolset provides an easy mechanism for crossing databases, by allowing data retrieved to be converted into hypertext links. In this section, we will review the major news and updates regarding the ESO Archive query forms.

3.1. Observing Program Information and Scheduling

Starting Oct 3, 2004 and following the decision of the Science and Technology Committee (STC), the abstracts of ESO proposals are publicly available once the proprietary period of the associated data is over. Access is enabled through the regular ESO Observation Schedule interface:

`http://archive.eso.org/wdb/wdb/eso/sched_rep_arc/form`

The result pages of this query form now include links to raw and, where available, science products associated with Observing Programmes. Also included are links to ESO data-based publications recorded in the ESO Telescope Bibliography database.

3.2. Public Datasets and Packages

Starting from the end of the Science Verification period, all data obtained with an instrument are public once the proprietary period is over. In addition, some data from the Commissioning and Science Verification phases of an instrument may be made public to the astronomical community. In such cases, those data are released through packages, as public datasets:

`http://archive.eso.org/archive/public_datasets.html`

ESO also provides advanced data products from surveys like EIS.

3.3. General and Instrument Specific Query Forms

The ESO Archive plans to offer instrument specific query forms for each instrument present in the Archive. The aim of an instrument specific form is to quickly retrieve information and identify frames related to the relevant instrument, based on specific keywords, like filter, grism, chip, etc. Some of them are already available:

FORS1	`http://archive.eso.org/wdb/wdb/eso/fors1/form`
FORS2	`http://archive.eso.org/wdb/wdb/eso/fors2/form`
UVES	`http://archive.eso.org/wdb/wdb/eso/uves/form`
ISAAC	`http://archive.eso.org/wdb/wdb/eso/isaac/form`

Those forms serve a complementary role to the generic observation form, which is based on principal information such as time or position:

VLT	`http://archive.eso.org/wdb/wdb/eso/vlt-obs/form`

3.4. ESO Data-based Publication Query Form

This web interface links scientific papers based on ESO observations with underlying observing proposals and archival data. It is accesssible from:

`http://archive.eso.org/wdb/wdb/library/publications/form`

It offers search options for bibliographic details of individual papers as well as for queries by observatory site, telescope, instrument and proposal ID. This ESO Telescope Bibliography can also be queried through a filter implemented at the ADS Abstract Service[3], with soon-to-come active links to the ESO Archive. These services are prerequisites to the astronomical Virtual Observatory as they allow the user to keep track of the entire lifetime of a scientific proposal: from scheduling, to observations and publications.

4. Toward a Science VO Compliant Archive

Reduced ESO Science Products from UVES Service Mode are currently added to the Archive on a regular basis as data packages. It will be extended to all instruments and Large Programs (Pirenne & Quinn 2004).

Internal FITS data integrity for HOTFly–1 concerns mainly generic keywords, thus a new release of HOTFly is on-going. Indeed, one of the difference between HOTFly–1 and HOTFly–2 will be the extension to all the instrument specific keywords, so the full instrument support.

Benefits of these initiatives (reduced data, high quality meta-data) are large for the future VO users of the Archive.

References

Pirenne, B., & Quinn P. 2004, The Messenger, 116, 48

[3]`http://esoads.eso.org`