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Operating the TNG Data Handling and Archiving

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Abstract. In this paper, the mechanism allowing the handling and on-line archiving of technical and scientific data from the Italian National Galileo Telescope (TNG) is described; the experience made during the initial months of operations is also discussed.

1. Introduction

An important feature of the Italian National Galileo Telescope (TNG) is the tight coupling between the control, the data handling, and the data archiving systems. In particular, a well-defined interface allows integration between two important TNG components: the high-level control system (WSS, the Workstations Software System) and the Handling and Archiving Tool (HAT) of the Archives at the Telescope (AaT) system.

For integrity reasons, all information being handled by the control system, both astronomical images (scientific exposures) and technical information (commands, status of telescope and instrument sensors, in the form of telemetry) follow the same path to the archives at the TNG. This allows a single and centralized mechanism for storing the data of the various instruments, both technical and scientific, in FITS format. At the same time, all technical information derived from the control system telemetry can be stored in the on-line archive.

2. System Implementation

The concepts for the TNG WSS system have been given in Pucillo (1994); details are available in Vuerli (1998)[1]. In Pasian (1996, 1998[2]) the principles of the AaT and some design details are discussed. The interactions between the two systems are described in Balestra et al. (1997) and Vuerli et al. (1998).

[1] `http://193.205.102.43/astrotech/articles/vuerli.pdf`

[2] `http://193.205.102.43/astrotech/articles/pasian_paper_1.pdf`

2.1. Structure of HAT

Figure 1 shows a simplified scheme for the handling of all TNG data, both telemetry and images.

The AaT is composed of the On-line Archive and the HAT and DART processes. The a On-line Archive is represented by a dashed box in the middle of the archive server (AS); it is composed of the Database and the Data Store. The AaT processes are represented by the white boxes, the HAT being composed of 4 processes (TAG, DTIN, DTOUT and DTFLUSH) and the DART by the AaT_UIF process alone. Other processes external to the AaT system are represented by gray boxes. Data storage systems are also shown: disk symbols are used for on-line storage, tape symbols for off-line storage. The data flow is marked with arrows: telemetry with thick dotted ones, science data with thick solid ones, and data descriptors with thin solid ones. The flow of commands and messages is indicated with thin dotted arrows. Instruments, either integrated with the WSS or not, are marked as two triangles.

For TNG instruments integrated with the standard control system (GATE and WSS), the flow of telemetry is saved by the WSS on a staging disk attached to a workstation (e.g. IWS): each telemetry item is stamped with an appropriate time stamp. The Telemetry-Archive Gateway process (TAG) is warned whenever new data are available and issues a message to the HAT system, running on the archive server (AS). DTIN manipulates the telemetry and updates accordingly the Database and the Data Store (the Technical Archive).

2.2. FITS Files

To allow the maximum homogeneity in the data produced by TNG instruments, a major feature of the design is that FITS files for the science frames are built by the HAT, provided that the instrument control is integrated with the WSS. In this case, the FITS files are actually built by DTOUT, which derives from the raw images, from the telemetry and from the Database the parameters needed to populate the keywords, and updates the FITS section of the Database and the Data Store.

The contents of the FITS header can be configured by editing ASCII tables, the `par2key.tab` files: of the keywords specified in the file, only those having a "write" (`w`) flag set are actually written into the FITS header. DTOUT is the HAT process which reads the general TNG table (`par2key_GEN.tab` (containing the TNG common FITS keywords descriptions) and the instrument-specific one (`par2key_<instrument>.tab`, where `<instrument>` is the TNG instrument name), and which combines the information to build the FITS header.

Some of the FITS keywords are used to build database tables. This action is configurable, as another editable ASCII table (the `key2db.tab` file) is used. Database tables are linked together in relations that allow a standard relational DBMS to handle the whole structure. Tables can be viewed separately during database browse operations, or views may be created (via the user interface) by making use of the links among tables. All fields, hence stored FITS keywords, can be used to search the Database.

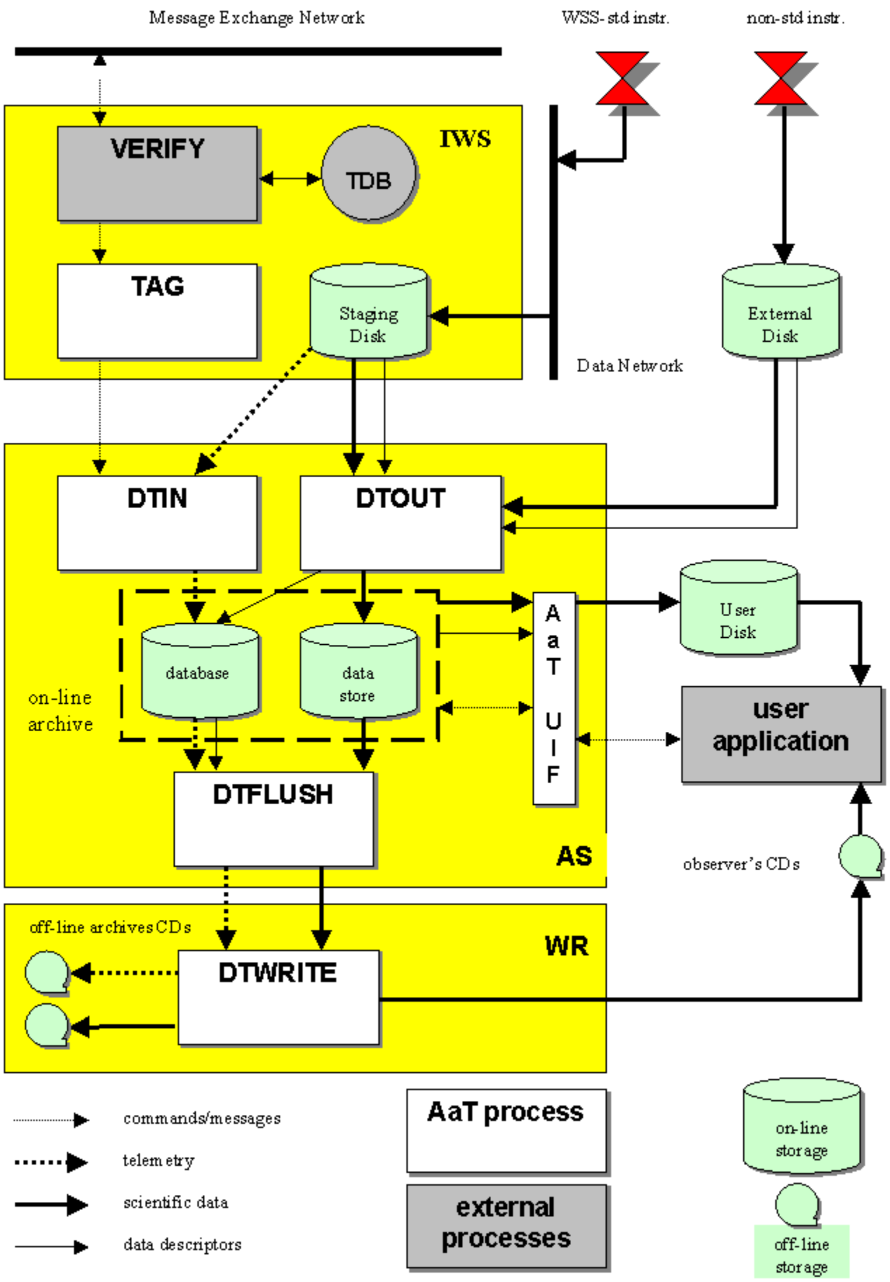

Figure 1. The TNG data handling concept and data flow.

3. AaT Operations

The AaT version currently operating at the TNG is 1.1, installed in July 1999. This version supports successfully the TNG four Technical Cameras, the active optics and two scientific instruments: the OIG optical imager and the ARNICA near-infrared camera. It is to be noted that, while OIG follows the standard data handling mechanism, ARNICA is not integrated in WSS. The table-driven system gives enough flexibility so as to allow smooth integration of the other instruments, to be installed next year: the DOLORES Low Resolution Spectrograph, the NICS Near-Infrared Camera and Spectrometer, and the SARG high-resolution spectrometer.

The AaT system also handles the on-line data repositories and archives at the telescope, where recent observations and conveniently unscrambled telemetry can be retrieved for monitoring or on-line processing purposes.

Since delivery and installation, 178 WSS sessions (both technical and observational) have been run, for a total of 8103 FITS files written. The mean time for an image to be acquired from the WSS system, formatted in FITS, stored on the archive, and ready for download to be processed by users has been 2.5 minutes. The system has proven to be efficient and reliable; only minor problems have been found and have been solved as part of the AaT maintenance.

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