Gaia data processing

Quality assurance, configuration management, tools and methods, activities for software engineering within the DPAC

The scientific processing of data from GAIA is a major challenge

■ **It involves the construction of a highly complex hardware and above all software system, capable of processing the data and achieving the expected results**

- ◆ Within the expected timetable. The time constraint in this instance is very severe.
- ◆ With the expected accuracy of the results
- ◆ With a total degree of confidence in the results

■ **and this:**

- ◆ Within a complex organisation involving dozens of laboratories
- ◆ With a large number of researchers who are not professional developers
- ◆ With a considerable need for resources

The survey conducted at the beginning of 2006 on languages showed:

■ **That experience of major developments was low**

■ **That the majority of developers do not have any experience of cooperative development**

■ **That the availability of developers is generally reassuring.**
  - ◆ **30 out of 40 envisaged being present up to 2015 and beyond.**

■ **That experience of Java programming was low**

■ **That the developers were ready to make an effort to commit themselves to new development practices and in particular to undergo training in Java.**

The need for implementing uniform practices within the DPAC:

■ **Regarding the tools shared by the whole of the consortium**

  - ◆ **To facilitate exchanges and communication**
  - ◆ **To trace technical facts (bugs, change requests, etc.)**
  - ◆ **To facilitate transfers and deliveries of documents and software between DUs or between DUs and the DPC**
  - ◆ **To automate recurring tasks,**
  - ◆ **To ensure the permanence of the elements generated (backup)**

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The need for implementing uniform practices within the DPAC:

◆ **Regarding the recommended individual working environments**

- To provide suitable tools for all
- To facilitate communication between developers from a same team and a laboratory
- To facilitate technical support

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The need for implementing uniform practices within the DPAC

■ **Regarding the development processes and expected deliverables:**

- ◆ **To standardise development practices and the associated terminology,**
- ◆ **To be able to better monitor and validate the functionalities to be implemented,**
- ◆ **To help master the complexity of software integration,**
- ◆ **To apply the usual software project development and management practices**
- ◆ **To continually control the quality of deliverables,**
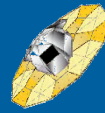
The development of the Gaia data reduction system implies common management, cooperation and development practices and tools.

Examples

A collaborative communication tool: GaiaWiki

- For presenting up-to-date information for reach CU (and avoid each CU having to manage its own Web server)
- For preparing meetings and workshops
- For managing distribution lists
- For submitting documents for discussion within a CU or a DU: each member of the CU can add their comments, proposals..... to the Wiki online
- Etc.

http://www.rssd.esa.int/SA-general/Projects/GAIA/wiki/index.php?title=Data_Processing

A reference document management and archiving tool

■ Livelink

- (see shared resources, documentation in Gaia WIKI)

A technical facts management tool (anomalies, change requests, etc.): Mantis

The management of technical facts at DPAC and CU level is an essential management activity :

- For following-up project actions
- For tracing and managing change requests, bugs (configuration, document)
- For enabling all project actors to know the state of advancement of the technical items that concern them

http://www.rssd.esa.int/mantisSI/my_view_page.php

A software and document configuration tool and service : subversion

The cooperative development of a large software project requires a method and tool to be used that can:

■ Manage successive versions of the software,

■ Trace changes, and manage problems posed by the involvement of a number of developers on the same software,

■ Finely manage the access rights of each project actor or group

■ Provide a centralised means containing all of the project resources,

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A software and document configuration tool and service : subversion

■ Permit the implementation of an totally secure and unique backup* system for the entire project,
   ◆ the ESAC subversion database is backed-up locally and, from November 2006, will be backed-up to a remote CNES site.

Offer simple integrated access to the Developpers, using online commands or a Web browser,

Technical common reference documents

- DCI : specification of interfaces between the main data base and the CU subsystems

- DCI internal for each CU

- PAED

- WBS

- Etc.

Observation

One year ago, each CU was still using its own methods to manage:
- Its Web server
- Its circulation lists, associated tools, forum, etc.

The implementation of common tools by the CUI now provides significant advantages:
- No duplication of effort of setting up the tools and maintaining them in operation
- The many individuals involved, in several CUs, find the same information in the same places, regardless of their CU.

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PAED

- **The requirements applying to DPAC software development have been defined and collected together in a document called PAED**

This document has been defined on the basis of a set of standards that generally apply to space projects:
- Simplified Quality Assurance Provisions For Software Development, RNC-CNES-Q-80-509
- Software product assurance, ECSS-Q-80b
- Software ECSS Principles and requirements, ECSS-E-40b
- ECSS Functional and Technical specifications, ECSS-E-10 part 6a
- Space Project Management – Configuration Management ECSS-M-40B
- ECSS-M-50B Draft 8 "Space project management - Information/documentation management"
- Etc.

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PAED

- **The aim is for the DPAC to have at its disposal a single document containing a summary of the standards applying to Gaia.**

- **A significant effort has been made to simplify the existing standards.**

- **But it is essential that the scientific community makes an effort to apply new practices.**

- **There is also a great demand from the ESA for this:**
  - ◆ It is for this reason that the PAED was established jointly by the CNES team, the ESAC team and the ESTEC Quality Assurance department
  - ◆ Formal reviews organised by the ESA are planned
  - ◆ This requirement is justified in the context of Gaia

PAED

■ **A document that is difficult for scientists to understand**

■ **A vocabulary and formulation of applicable requirements with which they are unfamiliar**

■ **Practices, procedures, rules, tools and methods with which they are only slightly or not at all familiar**

■ **Hence the need to assist the development teams in the DUs with these new practices**

PAED : New practices: CU and DU support plan

■ **Four-day Java workshops in Toulouse (organised within the framework of CU1)**
  ◆ **Two days devoted to Java**
  ◆ **Two days devoted to the tools available within the DPAC**

■ **Technical workshops organised within each CU**
  ◆ **E.g.: a two-day CU workshop in October**

■ **Availability of teaching materials on GaiaWiki : software toolkit**
  ◆ **Currently in progress**

■ **The targeted intervention of each technical coordinator within the DUs/WPs**

■ **Any other support requested by the CUs**

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A long term process

■ We know that new working practices cannot be implemented in one day

■ After organising the DPAC, we must now all concentrate our efforts on the CUs and DUs

■ The cyclical development principle
   ◆ With six monthly document and software deliveries
   ◆ With assessments of all aspects of development
   ◆ With internal reviews

===> should allow us to implement common methods and tools within the cycle 2

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A good understanding of all developers is essential

■ **It is necessary to know when and how to apply the requirements defined in the PAED**

   ◆ **Example: the traceability of changes and anomalies in Mantis is only becomes essential once an initial version of the algorithms is produced**

■ **We should do all that is necessary and at the required time, but not more**

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Development management is based on two foundations

■ **Documents describing :**

- ◆ the expected functions that which must be implemented (specification),
- ◆ how it is to be implemented (design)
- ◆ and how to confirm that which is implemented is that which is expected (a test plan).

For this:

- ◆ The requirements are defined in "Software Requirement Specification" or SRS documents,
- ◆ A response to these requirements is set out in "Software Design Documents" or SDDs,
- ◆ The means of checking that each requirement is validated is described in a "Software Test Plan" or STP document.

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Development management is based on two foundations

Requirement management (traceability between the different documents) is necessary:

- ◆ **For taking account of the next level up:**
  - • all of the SRS documents of each DU meet the SRS document of the CU.
  - • A CU requirement can be fine-tuned for the DUs concerned.

- ◆ **To ensure that the chosen design meets the requirements of the same level SRS**

- ◆ **To ensure that validation of the developed software is complete.**

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Conclusion

- **Today's presentations are therefore only an outline for a PAED implementation support process**

- **The PAED must be applied at the appropriate level ;**
  - We must be able to produce all the necessary documentation without producing too much
  - We must know when to deal with problems within the development team and when it is necessary to trace these problems in the Mantis database
  - We must be able to implement software configuration management at the right times and no more often than necessary
  - Etc.

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Conclusion

- **The ESA is extremely attentive to these aspects :**
  - formal reviews are already planned :
    - System requirement review – August 2007
    - Critical design review – October 2008

- **It is essential that everyone feels concerned by this subject:**
  - This is a necessary condition of the success of the DPAC
  - Everyone must be able to find the training support they need within the DPAC