Chapter 15

Galileo Case Study: A Collaborative Design Environment for the European Space Agency’s Concurrent Design Facility

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ABSTRACT

The Concurrent Design Facility (CDF) of the European Space Agency (ESA) allows a team of experts from several disciplines to apply concurrent engineering for the design of future space missions. It facilitates faster and effective interaction of all disciplines involved, ensuring consistent and high-quality results. It is primarily used to assess the technical and financial feasibility of future space missions and new spacecraft concepts, though for some projects, the facilities and the data exchange model are used during later phases. This chapter focuses on the field of computer supported collaborative work (CSCW) and its supporting areas whose mission is to support interaction between people, using computers as the enabling technology. Its aim is to present the design and implementation framework of a semantically driven, collaborative working environment (CWE) that allows ESA’s CDF to be used by projects more extensively and effectively during project meetings, task forces, and reviews.

INTRODUCTION

The particular chapter focuses on the field of computer supported collaborative work (CSCW) and its supporting areas whose mission is to support interaction between people, using computers as the enabling technology.

Researchers and scientists from fields such as computer science, sociology, psychology, anthropology, and information science seek to understand the nature of work and the complexities of human interaction for the express purpose of building computer-based systems which support and enhance inter-personal activities.

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CSCW looks at the way users interact and collaborate with each other, and attempts to develop guidelines for developing technology to assist in the communication process. These systems are known as Groupware. A successful groupware should fulfil the following requirements:

- Make its users aware of being participants within a collaborative effort.
- Provide cues regarding the actions and their effects taken by the other participants.
- Enable communication between the participants.
- Allow the sharing of resources.
- Awareness features built into the application.
- Fully customisable and highly integrable environment.
- Cross domain collaboration support through different collaboration modes (synchronous, semi-synchronous and asynchronous).

The chapter describes the delivery of a prototype Collaborative Working Environment (CWE) that leverages the functionality of the Concurrent Design Facility (CDF) of the European Space Agency (ESA). In particular, it will address the needs for three main activities:

- Distributed design sessions
- Concurrent reviews
- Distributed Anomaly Investigation Boards (ESA, 2011)

Ultimately, it will allow the CDF to be used more extensively and effectively and extend its use in later phases of the design of space missions.

**THE TARGET DOMAIN**

Founded in 1975, the European Space Agency (ESA) is the independent space organisation of Europe, and its purpose is to promote cooperation between European States in space research and technology and their space applications.

The Concurrent Design Facility (CDF), ESA’s main assessment center for future space missions, is located at ESTEC (European Space Research and Technology Centre) in the Netherlands. It uses the concurrent engineering (CE) methodology to perform cost-effective, fast and high-quality space mission studies (Wikipedia, 2011). Equipped with state of the art network of computers, multimedia devices and software tools, the CDF allows interdisciplinary teams of experts to perform design studies. It has achieved this through the use of its Integrated Design Model (IDM), which makes use of spreadsheet technology, both as data storage and as engineering tool, to achieve interdisciplinary collaboration (Integrated Design Model, 2012).

The growing interest of ESA partners, Industry and Academia in the ESA CDF core IDM, revealed the need for standardised data representation and exchange, and common design methodologies, but at the same time exposed the limitations of the IDM communications layer for use in distributed concurrent design. This has motivated the creation of the Open Concurrent Design Server (OCDS), which makes use of a Service Oriented Architecture (SOA) using web services, a centralised database and many client tools such as the OCDS Study Manager (OSM) and OCDS enabled spreadsheets. An initiative of ESA, the OCDS provides the building blocks of a Concurrent, Collaborative and Distributed Engineering for the European Space Industry, using Open Standards Information Models and Reference Libraries (OCDS User Community Portal, 2012)

The OCDS is the vehicle to distribute CDF’s concurrent design methodology and a set of tools to the Space industry, organisations and academia. At the same time, it distributes an open data exchange standard for early phase space system engineering and design activities.

The OCDS is built on a common Space Engineering Information Model (SEIM), which is the common upper level ontology for early phase concurrent design and engineering in ESA. It
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