# DAMIEN

**Distributed Applications and Middleware for Industrial Use of European Networks**

**Abstract**

The DAMIEN project aims at designing middleware to support a particular kind of distributed application, known as a close-coupled application, and at assessing the middleware using industrial applications across the European GEANT network. The project started in early 2001 and finishes in October 2003. It continued the successful work of the European pilot project for GRID-Computing METODIS. The latter has shown successfully the feasibility of the GRID-approach in industry. The objective of DAMIEN is to develop further building blocks for a middleware environment for distributed industrial simulation and visualisation in the GRID. Besides the multi-protocol MPI-library PACX-MPI for heterogeneous networks, this includes the handling of Quality of Service requirements in distributed simulations. The coupling code interface MpCCI allows the linking of distributed applications. Tools for performance analysis (Vampir) and performance prediction (DIMEMAS) offer extended GRID-awareness. Applications from industry serve as test cases for the developed software.

**Objectives**

The purpose of DAMIEN is to respond to the emerging infrastructure of computational resources connected by high speed networks which is generally described as the GRID. DAMIEN aims at developing a middleware toolbox which allows application-developers to port their applications to computational GRIDs as well as to ease the handling of distributed computing environments. The toolbox is developed by extending existing tools. The second goal of the project is then to test these tools by industrial applications on a testbed based on European and national high speed networks.

**Technical Approach**

Central part of the DAMIEN architecture are standards used by industry (i.e. the message-passing standard MPI), and libraries and tools, which the users of high performance computing facilities are familiar with. Based on these already existing tools (DIMEMAS, MpCCI, PACX-MPI, Vampir), DAMIEN defines the necessary extensions to support GRID-computing environments creating a software development environment for GRID-computing. The extensions can be split basically in three parts:

- Integration of an additional communication layer that has to be introduced to reflect the characteristics of distributed environments.
- Integration of Quality-of-Service (QoS) handling into the tools for enabling a flexible network resource management.
- Ease the usage of the distributed tools and distributed environments.

**Testbed**

The toolbox developed in the frame of the DAMIEN is being validated on a testbed based on the European high speed networks between the three research centers of the project (CEPBA, CRIHAN, HLRS). The usability of the tools has also been demonstrated on a testbed of HPC-resources distributed world-wide for the HPC-Challenge at SuperComputing 2002 in Baltimore.

**Application**

EADS CCR provides a multi-physics application. The application is a new strongly coupled method for vibro-acoustic simulation, which can be used e.g. to simulate the propagation of noise during the launch-phase of rockets or for noise-reduction simulations inside plane-cabins. Due to a high number of entities in the company and their geographical distribution all over Europe, this projects validates GRID-computing as a solution for industrial users.
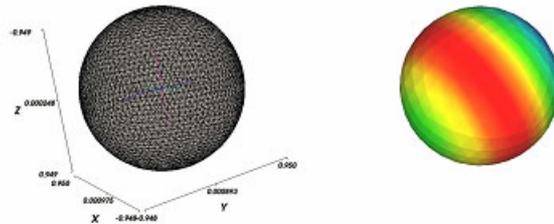


### Innovation

Two major innovations are achieved within the DAMIEN project: First, the project provides the first development environment for end-users including standards, libraries and tools, which they are used to deal with from their regular working environment. Tools like Vampir, DIMEMAS, MpCCI are highly accepted in the area of parallel computing, and are now also made available in GRID environments.

The second major innovation in the project is the integration of the Quality of Service module into the communication software as well as into the tools. Since the performance of GRID applications is strongly influenced by the network between different machines, the management of the network resources is a key issue for GRID environments and their applications.

### Results

The tools developed in the project have been successfully used to run and verify the industrial application on the testbed installed at EADS CCR.
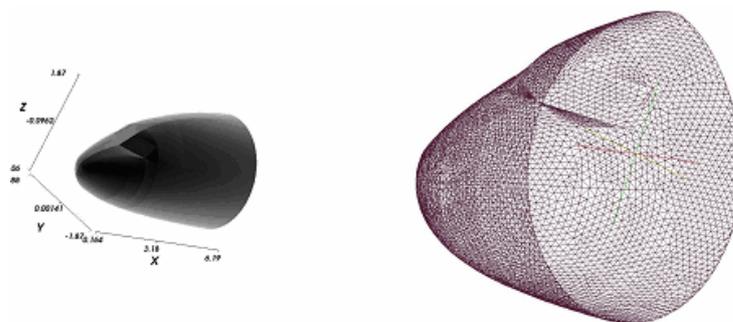


### Success stories

During the DAMIEN project a tool-set for distributed Grid environments was developed, which is based on widely accepted tools and libraries from the area of high performance computing, and supports the end-user
during the development phase of applications and the execution of production runs.

Actually, the DAMIEN solution is used at EADS CCR to solve multi-physics problems during the development and designs phases of the new Airbus cockpit. This will help to reduce development costs which have an important influence on final product costs.

Secondly, the exploitation of the tools has been started. For instance, the improvements in PACX-MPI achieved during the project helped to popular the library. In fact, it is deployed in other IST Grid projects (COREGRID and GridLab).

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DAMIEN

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198

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Collaboration with other EC funded projects:
GRIDSTART
GRIDLAB

**IST - Research Networking - Research on Networks – Grids**