

Fellowship	Object oriented environment for HPC applications on the Grid	
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Period	University of Pisa, October 1, 2005 to April 30, 2006	

1. Introduction

The objective of the proposed fellowship is to integrate POP-C++ [1], an object-oriented distributed programming model developed by the University of Applied Sciences Western Switzerland with ASSIST [2], a component based parallel programming environment developed by the University of Pisa. This would provide a complete chain of tools, from the programming language to write the grid application up to all the necessary services to run the application in a grid infrastructure.

The fellowship was scheduled in 14 months, with two 7-months periods, one of them split in two parts. The first period started in Switzerland, and was paused after three months, yielding to the second period in Italy. The first period was restarted after the end of the second, for four more months. **This report concerns the period in the University of Pisa, Italy.**

2. Research activities

ASSIST is a parallel programming environment providing a skeleton [3] based coordination language. Parallel applications are generic graphs where the nodes are components of either parallel modules or sequential code and the edges are data streams. Different strategies can be experimented by just changing some lines of code. The model relieves the programmer from many concerns of classical, non structured, parallel programming frameworks, as mapping, scheduling, load balancing and data sharing, as they can be automatic and optimized, because the code contains a description of the parallelism structure.

GEA is a tool belonging to the ASSIST environment, aimed for launching the components of its applications, targeted for distinct architectures, as grids and clusters. It has a modular design, intended for aggressive adaptation to different system architectures and to different application structures. GEA deploys applications as well as its infrastructure based on XML application description files. It makes virtually possible to configure and launch processes in any combination and order needed, adapting to different types of applications.

The work done in Pisa can be divided into three phases. The first phase consisted on study and evaluation of the ASSIST environment. The second phase was devoted to the design of the architecture for the extension of GEA to support the deployment of POP-C++ objects. The third phase was the development of such an extension. This work has been done in cooperation with all the local teams in Pisa, including not only the Computer Science Department, but also the CNR/ISTI team, which is also in CoreGRID.

For study and evaluation of ASSIST, some toy applications were developed following coursework available on their website. All tools necessary for compiling and running

ASSIST applications were available in the department server (including GEA). This phase coincided with the preparation of the first version of an article submitted to the CoreGRID Integration Workshop to be held in Pisa.

To design the architecture of GEA's extended version it was necessary to understand its internal structure. This knowledge was acquired by direct code inspection and incremental modification, as well as some meetings with the people that developed it (Paolo Pesciulesi, Silvia Magini, Nicola Tonellotto). The result of this phase was a second article sent to publication in the Volume 4 of the Springer CoreGRID proceedings series. A third article was prepared with Patrizio Dazzi and Luigi Presti in this period, concerning Java automatic bytecode transformation for parallel programming, submitted to Parallel Architectures and Compilation Techniques.

The third and longer phase was dedicated to the development of the extension itself. Care had to be taken with some existing problems with GEA, related to application description, resource discovery, and matchmaking. Large parts of code were added, integrating previous works developed in the Computer Science Department as well as in the CNR/ISTI. In total, GEA grew from 19000 to 33000 lines of code. The period in Pisa terminated with the debugging of the extension code.

3. Conferences and meetings attended

GRIDs@Work: Grid Plugtest 2nd edition

- Sophia-Antipolis, France, October 10-14, 2005
- Attended to ProActive User Group meeting and the two CoreGRID workshops (Grid Systems, Tools and Environments; Programming models and components for the Grid)

CoreGRID Workshop on Integrated Research in Grid Computing

- Pisa, Italy, November 28-30, 2005
- Presented the paper "Skeleton Parallel Programming and Parallel Objects"

4. Publications

Marcelo Pasin, Pierre Kuonen, Marco Danelutto and Marco Aldinucci, "Skeleton Parallel Programming and Parallel Objects." CoreGRID Integration Workshop 2005, Pisa, Italy, November 2005.

5. References

- [1] Tuan-Anh Nguyen and Pierre Kuonen, "A Model of Dynamic Parallel Objects for Metacomputing." PDPTA, pp. 192-198, CSREA Press, 2002.
- [2] Marco Vanneschi, "The Programming Model of ASSIST, an Environment for Parallel and Distributed Portable Applications." Parallel Computing, 28(12), pp. 1709-1732, 2002.
- [3] Murray Cole, "Bringing Skeletons out of the Closet: A Pragmatic Manifesto for Skeletal Parallel Programming." Parallel Computing, 30(3), pp. 389-406, 2004.