



**Project no. FP6-034442**

## **GridCOMP**

**Grid programming with COMPONENTS : an advanced component platform  
for an effective invisible grid**

**STREP Project**

**Advanced Grid Technologies, Systems and Services**

**D.DIS.04 – GridCOMP introductory material, slides, tutorial, sample code on  
the GridCOMP WEB site**

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### **Summary**

This document presents the training materials available on the GridCOMP web site<sup>1</sup> under the documentation section<sup>2</sup>. These web pages present an introduction to the results of the GridCOMP project with many links to other resources related to the GCM, i.e. slides, tutorial courses, sample code, etc. A large part of these materials have already been used for a tutorial course, for instance during the first GridCOMP workshop part of the GRIDs@Work week, in 2007.

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<sup>1</sup> <http://gridcomp.ercim.org/>

<sup>2</sup> <http://gridcomp.ercim.org/content/blogcategory/22/27/>

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## 1 Introduction

Training activities have started as soon as a first prototype of the component framework has been designed. The objective is to ensure the broad adoption of GCM and to foster their deployment in the academic and industrial world, not only in Europe. Therefore, the training activities are often coupled with other dissemination effort like the first GridCOMP dissemination workshop. These tutorials are designed to spread the GridCOMP knowledge to advanced students/industry personnel and to the computer science community in general. Yet, to ensure an efficient training, GridCOMP will have to rely on Web-based Training activities. Indeed, the project has produced training materials and posted it on a dedicated section of the GridCOMP web site to allow anywhere/anytime access to all.

We present in this document the introductory training materials available on the GridCOMP web site under the documentation section. Since the first months of the project, we have made strong efforts to organize tutorials among other dissemination activities. In order to train the prospective end users — industrial and academic — a first version of training materials have been prepared and used after the first year of the GridCOMP project. It has been disseminated during the GridCOMP tutorial organized as part of the GRIDs@Work week<sup>3</sup>, November 2007, in Beijing. These materials are used as support for further dissemination and project exploitation. The GridCOMP training task, in WP6, is lead by INRIA in close collaboration with all the partners. These regular dissemination activities are carried out by several GridCOMP partners.

In the next section, we briefly present the different materials available so far. They contain links to many resources around the GCM: slides, step by step tutorial courses with sample code.

## 2 Training materials description

The GridCOMP documentation web pages present a first introduction to the results of the GridCOMP project. We have assembled materials around the four following themes:

- ProActive
- Basic GCM Features
- Automatic GCM Features
- Grid IDE

The first three items are related to the main concepts of the GCM and their implementation in GridCOMP, while the last one describes the Grid IDE – a toolset designed and developed for GCM users and developers using the Eclipse framework.

The Annex: GridCOMP documentation web page of this document contains the current GridCOMP documentation web pages with all the links to the available resources which have

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<sup>3</sup> <http://www-sop.inria.fr/oasis/plugtest2007/ProActiveGCMTutorial.html>

been used as training materials. We detail the main elements in the four following subsections.

## 2.1 ProActive materials

ProActive<sup>4</sup> is the middleware used by GridCOMP to provide the reference implementation of the GCM, therefore it is important at a first time to give basic information allowing users to get started with it. In addition to link the full ProActive documentation, we highlight two specific resources allowing GCM users to start to be comfortable with the ProActive library and its main concepts.

- *Slides: ProActive/GCM tutorial and Hands-On Grid Programming*  
This presentation is a short introduction to the ProActive library, from the programming framework to the deployment system. It explains asynchronous communications, futures, and group mechanisms which also exist or are used in ProActive/GCM. It also contains brief introduction to the GUI and tools available with ProActive and shows some applications developed using ProActive.
- *Hands-On tutorial: Through a HelloWorld example and a Master/Worker application finding the first N primes, this tutorial presents in details the ProActive API and its features. The source code is available for download as a set of ready to use Eclipse projects.*

In this page, we also reference the D.DIS.03 deliverable, which contains a technical description of the GCM implementation using ProActive.

## 2.2 Basic GCM Features materials

In the documentation web pages, this section is dedicated to materials explaining what the GCM is. Also, the GCM key principles are presented. We have prepared presentations and a documentation including step by step tutorial courses and sample code to describe and illustrate the GCM.

- *Slides: GridCOMP Tutorial - GCM Component Programming*  
This presentation aims to introduce concepts of the GCM programming model and how the concepts are used with the ProActive/GCM reference implementation. It shows the ability of the model and its implementation to provide solutions for parallel, distributed and multi-threaded computing.
- *Hands-On tutorial: Through simple examples, usage of the GCM API, multicast interfaces and the Fractal ADL file are explained and illustrated. The source code is available for download as Eclipse projects ready to use.*

## 2.3 Autonomic GCM Features materials

One of the key GCM features is the autonomic capabilities. ISTI/CNR and UNIPI partners have prepared materials to present the adaptive behaviour with GCM. This web page also references related publications.

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<sup>4</sup> <http://proactive.inria.fr/>

- *Code and tutorial:* The D.NFCF.02 GridCOMP deliverable produced at the end of the first year of the project contains the code of one self-management pattern and the documentation to use it.
- *Slides:* These two set of slides presented at GridCOMP and CoreGRID<sup>5</sup> meetings explain the GCM autonomic features and what has been achieved in the implementation. Benchmarks and experiments with one GridCOMP use case are also detailed.
- *Hands-On tutorial:* Like with the hands-on tutorials previously presented, this step by step tutorial explains the usage of autonomic controller and autonomic manager with a demonstration application, the Monte Carlo Pi computation. The source code of the Monte Carlo Pi application is available as Eclipse projects ready to use in an Eclipse workspace.

## 2.4 Grid IDE materials

The Grid IDE (GIDE) is an advanced environment for programming and deploying GCM components on the Grid. We have prepared presentation and documentation materials including step by step tutorial to describe and illustrate the great features of this toolset based on the Eclipse framework.

- *Slides and step by step tutorial:* GCM component programming with ADL: A Methodology using Grid IDE. These slides present the strategy adopted for the GIDE design and architecture. It also contains screenshots and a description of the different perspectives and views provided by the GIDE.
- *Publications:* The D.GIDE.02 deliverable describes the overall aims and functionality of the Grid IDE early prototype from the perspective of two different communities: developers and data centre operators. A more recent conference paper complements this description.
- *Code:* A link to the latest release of Grid IDE for download and install is available. Also, there is a Web-based bug and suggestions reporting system.

## 3 Conclusion

In this document, we have presented the materials currently used for the GridCOMP training activities and available on the project web site. Indeed, we will continue to refine, update and improve it until the end of the project, when a final version will be delivered. All these materials are designed to attract and target a large and wide audience from academic to industrial users, with different levels of expertise from software architecture to software development. Concept and key ideas are presented as well as technical information allowing trainees to test and experiment the current GridCOMP implementation and results.

Using these materials, other training activities will be organized, to show the unique and novel features provided by the GridCOMP environment to interested industrial entities. Such activities will also be performed to exploit the GridCOMP web site and provide users with up-to-date slides, tutorials, sample code, etc.

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<sup>5</sup> The CoreGRID Network of Excellence defined the GCM, <http://www.coregrid.net/>

## 4 Annex: GridCOMP documentation web page

Hereinafter you can see the content of the documentation section in the GridCOMP web site gathering all web pages containing training materials. These web pages are available at <http://gridcomp.ercim.org/content/blogcategory/22/27/>.

### Documentation

The [Grid Component Model \(GCM\)](#) defined in the CoreGRID European project, is based on the [Fractal component model](#) (for more information about Fractal see this [tutorial](#)) with extensions designed to handle the specific requirements of grid applications such as:

- collective interfaces
- autonomic behaviour
- deployment capabilities

The GridCOMP project provides reference Open Source implementation of the GCM. In this section we described the current results of our project and how to test and use them. First, you can find a short description of the ProActive Grid middleware used to implement the GCM. Then, the [Basic GCM Features](#) and [Autonomic GCM Features](#) pages described the implementation itself with slides, step by step tutorials and some sample code. Finally, in the [Grid IDE](#) part we present the GIDE tool which is under development. It will feature application design, monitoring and steering for GCM users.

If you are looking for information on which kind of application can take advantage of the GCM see the [Use Cases page](#).

### ProActive

**ProActive** is an **Open Source** middleware for **parallel**, **distributed** and **multi-threaded** computing. We use it in the GridCOMP project to provide reference implementation of the GCM. The implementation details of the GCM with ProActive are described in the [D.CFI.03 deliverable](#).

You can find more information about ProActive in the [documentation part](#) and especially with the [ProActive guided tour](#).

#### Slides

[ProActive/GCM tutorial and Hands-On Grid Programming](#)

#### Code & Tutorial

[ProActive step by step tutorial](#)

[Source code](#) used in the step by step tutorial (this archive contains several Eclipse project, you just have to put them in your workspace and then import them)

#### Download

[Latest release of ProActive/GCM](#)

### Basic GCM Features

The first main objective of GridCOMP is to provide the reference implementation of the GCM. First of all, this implementation based on the ProActive grid middleware implements the Fractal specification and therefore allows the design and development of **distributed** component application with transparent remote binding and communication. In addition, the GCM specific features are implemented as well:

**Interoperable deployment framework:** the ProActive deployment framework is currently used to achieve interoperability with various schedulers and infrastructure. Currently, the GCM deployment framework is being standardized at [ETSI](#); at the same time we are implementing this draft standard which will replace soon the ProActive deployment framework.

**Collective interface:** one of the key features of the GCM is the ability to express in the type of your

component - when you design your application - the collective behaviour of your interface. The GCM defines two new interface cardinalities: **multicast** and **gathercast**. With the first one you can express that your client interface transforms a single invocation into many; and with the second one you can define an interface which collects many invocations to transform them into one. For both cardinalities dispatch of parameters and aggregation of results can be customized.

### Stream interface

The following resources provide more information on the implementation with tutorial and sample code.

#### Slides & Documentation

[GridCOMP Tutorial - GCM Component Programming](#)

[User documentation](#)

#### Code & Tutorial

[GCM basic features step by step tutorial](#)

[Source code](#) used in the step by step tutorial (this archive contains two Eclipse projects, you just have to put them in your workspace and then import them)

#### Download

[Latest release of ProActive/GCM](#)

Get [access to the current SVN repository](#) of ProActive/GCM

#### Support

If you have any question or trouble using the ProActive/GCM you can contact the developers team using the

This e-mail address is being protected from spam bots, you need JavaScript enabled to view it [public mailing list](#).

## Autonomic GCM Features

### Objectives

GridCOMP main goal is the design and implementation of a component based framework suitable to support the development of efficient grid applications. The framework is evolved from Grid Component Model (GCM) specification defined within the Institute on Programming Model of the [CoreGRID Network of Excellence](#), and is implemented on top of the ObjectWeb ProActive Grid middleware. Among the main features, GCM supports the development and deployment of self-management grid applications based onto the autonomic computing paradigm, which is aimed to automatically enforce user-defined levels of QoS for the applications in instable execution environments.

The GCM source code and the documents linked here are referred to the development status after the first year of the GridCOMP project (D.NFCF.02 summer 2007). As regard the autonomic features, D.NFCF.02 supports composite components exploiting a self-optimising functional replication of stateless components. Several other self-management patterns are currently under test within the project. For additional information please contact Marco Danelutto (marcod AT di.unipi.it - GridCOMP WP3 coordinator).

### Slides

[Adaptative Behavior with GCM](#). M. Aldinucci, S. Campa, M. Danelutto, P. Dazzi, D. Laforenza, N. Tonellotto. Slides of the presentation held at GridCOMP meeting, Beijing, China, Oct 2007.

[Autonomic Features in GCM](#). M. Aldinucci, S. Campa, M. Danelutto, P. Dazzi, D. Laforenza, N. Tonellotto. Slides of the presentation held at CoreGRID plenary meeting, Paris, France, Jan 2008.

### Code and Tutorial

[GCM source code \(with basic autonomic and non functional features - early prototype\)](#). GridCOMP deliverable D.NFCF.02-code, Jun 2007.

[Usage tutorial of the GCM with basic autonomic and non functional features](#). GridCOMP deliverable D.NFCF.02, Jun 2007.

### Related papers

M. Aldinucci, S. Campa, M. Danelutto, M. Vanneschi, P. Dazzi, D. Laforenza, N. Tonellotto, and P. Kilpatrick.



[Behavioural skeletons in GCM: autonomic management of grid components.](#) In D. E. Baz, J. Bourgeois, and F. Spies, editors, Proc. of Intl. Euromicro PDP 2008: Parallel Distributed and network-based Processing, pages 54–63, Toulouse, France, Feb. 2008. IEEE.

M. Aldinucci, S. Campa, M. Danelutto, P. Dazzi, P. Kilpatrick, D. Laforenza, and N. Tonello. [Behavioural skeletons for component autonomic management on grids.](#) In M. Danelutto, P. Frangopoulou, and V. Getov, editors, Making Grids Work, CoreGRID. Springer, June 2008.

### GCM autonomic features step by step tutorial

Here you can find what you need to test the autonomic features of GCM, this material has been used for tutorial. At the bottom of the page you can find six links. Please click all of these and download all the files. The first file contains a PDF tutorial, the second one contains the libraries used by the others four zip files containing eclipse projects. The PDF tutorial explains you, step by step, how to use the projects.

#### How to install

After the files download, uncompress zip files and import them as projects inside your eclipse workspace. The Core project must be always-on, so you need to keep it open. The other project can be open in turn.

#### Files to download

[Tutorial](#)

[Libraries](#) used by the fourth following Eclipse project, **put these files in the lib directory** of each following project

[Core Files](#)

[Plain component Pi example](#)

[Pi example version with autonomic-controller](#)

[Pi example version with autonomic-manager](#)

## Grid IDE

The Grid IDE (GIDE) provides an integrated environment to support both the software development process and the data centre operations for GCM applications. The GIDE is released as plug-ins for the Eclipse framework.

### Slides & Tutorial

[GCM component programming with ADL: A Methodology using Grid IDE](#)

Grid IDE step by step [tutorial](#)

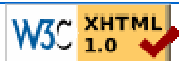
### Publications

[D.GIDE.02 deliverable](#) shows in more details the features offered by the GIDE.

A. Basukoski, V. Getov, J. Thiyagalingam, S. Isaiadis, [Component-Based Development Environment for Grid Systems: Design and Implementation](#), In M. Danelutto, P. Frangopoulou, and V. Getov, editors, Making Grids Work, CoreGRID. Springer, June 2008.

### Download

- [Latest release of Grid IDE](#) (Please refer to the Install and Release notes in the RAR archive)



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