Status report on the GRIDCC project

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INTRODUCTION

Recent developments in Grid technologies have concentrated on providing batch access to distributed computational and storage resources. INFN - Legnaro in September 2004 promoted GRIDCC, a 3-years EU FP6 project in collaboration with other European partners, to extend Grid infrastructure in order to provide remote access to and control of distributed instrumentation [3], [6], [7]. The aim of the GRIDCC architecture is to realize a standardized Web Service platform to integrate scientific and general purpose instruments and sensors within the Grid. As the instrument control involves both real-time issues and human interactive processes, the integration between instrument Grid and classical computational Grid also requires the definition of an acceptable Quality of Service approach for interactions between different components [2].

PROJECT OBJECTIVES

The goals of GRIDCC can be summarized as follows:

- develop a generic and flexible Grid Service Oriented Architecture, based on existing building blocks (Grid Services) to allow both remote control and monitoring of target instrumentats, such as heterogeneous scientific devices present in distributed systems.
- incorporate a newly designed middleware into a few major pilot applications, in order to validate the proposed software solution, both in terms of functionality and QoS profile: European Power Grid, Meteorology, Remote Operation of an Accelerator Facility, High Energy Physics Experiment, Remote Operation of Geophysical Monitoring Network and Device Farm for the Support of Cooperative Distributed Measurements in Telecommunications and Networking Laboratories.
- disseminate the new software solution and the test beds' evaluation results, in order to encourage large public companies and industrial stakeholders to adopt a Grid-oriented approach to deal with different scenarios necessitating a real-time control and monitoring of remote instruments.

MAIN APPLICATIONS

GRIDCC entering its final phase has consolidated the designed middleware that has been used in a representative set of real applications in order to validate the software produced by the project. The considered concrete use cases are meant to control and monitor different types of instruments, acquire data from these physical devices instruments and then analyse such available data on existing Grid networks. Such activities should demonstrate the achieved grade of integration of GRIDCC solutions with existing Grid projects.
The major concerns in identifying suitable testbeds are listed below:

- building state-of-the-art, scalable and cost-effective test beds sharable among remote users;
- providing standardized interfaces;
- producing test beds fully configurable and usable for joint experimentation and demonstrations;
- implementing several test-beds in different scientific areas, over the common architectural and software platform, in order to prove flexibility and adaptability of mature Grid technology.

RESULTS AND ACHIEVEMENTS AT THE 2ND YEAR OF THE PROJECT

As planned, the second year of the project has registered the official release of several components of the GRIDCC architecture. The main pilot applications of the project have been equipped with the released middleware deployed on different test beds.
The main results achieved during the year have been:

- first official release of the Instrument Element (IE) [1], the key module of the GridCC architecture, allowing a grid enabled access to the instrumentation. IE Web Service interface provides a high level virtualization of a real instrument representing the decoupling element between real instruments and the grid.
- first official release of VCR – Virtual Control Room – [4] to provide a reference graphical user interface and a collaborative environment for the remote users to act on instrumentation.
- workflow based service orchestration, providing access to the GRIDCC IEs and to the classic EGEE gLite components, like WMS, CE and SE.
- support and monitor of the real time and interactive requirements based on two levels (strict and loose) of QoS guarantees.

MIDDLEWARE DEPLOYMENT ON THE MAIN GRIDCC PILOT APPLICATIONS

The aforementioned GRIDCC features have been integrated into three main pilot applications:

- run control of a high energy physics experiment;

- the remote control and monitoring of a Grid of small power generators network [5];
- far remote operation of a particle accelerator.

The deployment of other applications, foreseen in the GRIDCC program, as well started in the second year (e.g. meteorology, control of the territory (geo-hazard), remote control and monitoring operations of telecommunication measurement equipment).

The aforementioned applications run on dedicated GRIDCC test beds. In particular GridCC middleware has been deployed to control the run on the real production environment of the CMS (Compact Muon Solenoid), one of the four high energy experiments in LHC (Large Hadron Collider) at CERN laboratory. CMS Magnet Test and Cosmic Challenge (MTCC), a milestone in the CMS construction, positively carried out.

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