


TITLE OF RESEARCH WORK: Adaptive Provisioning and Orchestration of Grid Services

Research Description:

This work focuses on the problem of how multiple services should be orchestrated in a grid environment to provide adaptive functionalities. The need for adaptation in grid infrastructures arises due to both resource and service demand uncertainty. Next generation of grid middleware must provide mechanisms to efficiently deal with uncertainty. The specific objectives of this project are: (1) to design a model for adaptive service provision and orchestration and (2) to design and implement mechanisms for adaptive denial-of-service detection and migration.

WALSAIP GROUP ASSOCIATION: Parallel and Distributed Computing Group	
THESIS TITLE: Adaptive Provisioning and Orchestration of Grid Services	
THESIS ADVISOR: Prof. Wilson Rivera	
INSTITUTION: Electrical and Computer Engineering Dept. University of Puerto Rico at Mayaguez	
PERSONAL WEBSITE: http://www.ece.uprm.edu/~s047267/	NAME OF RESEACH ASSISTANT: John Alexander Sanabria Ordóñez

RESEARCH PROJECT OUTCOMES:

Publications:

1. K. Cruz, J. Sanabria, F. Cintron and W. Rivera, "The PDCLab Grid Testbed at UPRM." Fourth LACCEI International Latin American and Caribbean Conference for Engineering and Technology (LACCET), 2006

Tools and Applications:

Globus Toolkit: (<http://www.globus.org>)

The Globus Toolkit (GT4) is an open source middleware used for building grid systems and applications. The Globus Toolkit 4.0 includes among other components services such as a security infrastructure (GSI), data transport service (GridFTP), execution services (GRAM), and Information services (MDS).

- The Grid Security Infrastructure is used by the Globus Toolkit for authentication and secure communication. GSI is implemented using public key encryption, X.509 certificates, and the secure sockets layer (SSL) communication protocol. GSI incorporates single sign-on and delegation.
- The Monitoring and Discovery Service (MDS) is used to discover, publish and access both static and dynamic information of different resources in a computational grid. MDS uses the Lightweight Directory Access Protocol (LDAP) to access such information about the different grid components and provides a unified view of the disparate grid resources.
- The Globus Resource Allocation Manager (GRAM) is used for allocation and management of resources on the computational grid using a Resource Specification Language (RSL) to request resources. GRAM also updates the MDS with information about the availability of grid resources. The GRAM API can be used to submit a job, query the status of a job, and cancel a job. A GRAM service runs on each resource that is part of the grid and is responsible for interfacing with the local site resource management system (e.g. OpenPBS, Condor)
- GridFTP is a secure, high-performance and robust data transfer mechanism to accessing remote data. In addition to GridFTP, Globus provides Globus Replica Catalog to maintain a catalog of dataset replicas so that instead of duplicating large datasets only necessary pieces of the datasets are stored on local hosts. The Globus Replica Management software provides the replica management capabilities for data grid by integrating the replica catalog and GridFTP.

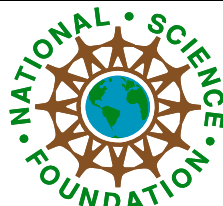
The adaptive functionality we are proposing will be implemented on top of the GT4 middleware.

GridSim: (<http://www.gridbus.org/gridsim/>)

GridSim is a Java- based discrete-event grid simulation package, which allows modeling and simulation of entities in parallel and distributed computing systems. We use GridSim as a simulation tool to evaluate the proposed scheduling and migration strategies.



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RELATION OF RESEARCH WORK TO WALSAIP PROJECT:

The research agenda of this particular project is to study adaptive service provision and orchestration in wide area networks, develop new concepts and apply them to the framework being designed under the WALSAIP project.

IMAGE REPRESENTATIVE OF RESEARCH WORK:

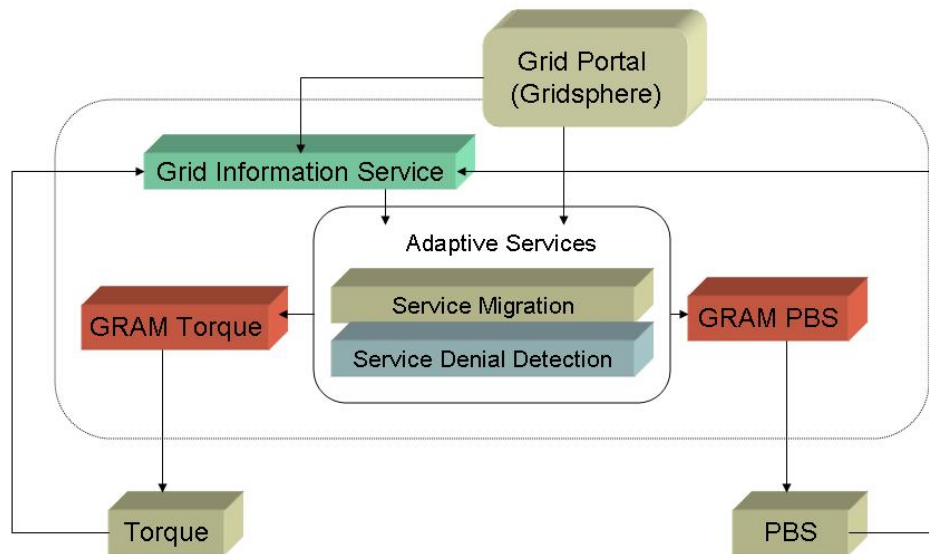


Figure 1: Adaptive Services Architecture

The proposed adaptive services (service migration and service denial detection) will be integrated on top of standard services provided by GT4. Information related to the availability and capability of resources will be accessed from a GIS (Grid Information Service) by the adaptive services manager. The adaptive service manager communicates to a specific GRAM (Globus Resource Allocation Manager), which is turn communicates to the local resource manager such as Torque or PBS, to provide new management policies. The adaptive service manager is accessible to the user through a Grid Portlet.

RESEARCH DEMONSTRATION:

As a proof-of-concept we plan to deploy a data replication service using the same conceptualization of the architecture for adaptive services. The data replication strategy is based on the information dispersal algorithm (IDA). Preliminary results show that the IDA based replication provides better reliability and less storage spending than traditional replications schemas.

A prototype of this replication service has been already implemented. In such an implementation GridFTP is used to improve data transport from the data server to a grid infrastructure; and data exchange between server and the grid infrastructure is authenticated using Grid Security Infrastructure (GSI). However, no interaction with the Grid Information Service (GIS) or even the Globus Resource Allocation Manager (GRAM) is provided. A deployment of the replication service will be delivery by the end of December 2006. This new deployment will provide the required interaction with GIS and GRAM to better decide the level of replication.



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