

A Grid-based Tool to Compose Signal Processing Operators Allocated on Distributed Resources

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March 14, 2007



Signal Processing Composition

- Problem Formulation -

The execution of a set of tasks associated with the [signal processing](#) may imply important consumption of computational and storage resources. Therefore, the use of distributed computing technology is a reasonable alternative. In addition to the optimization of resources, a distributed environment to signal processing also provides the opportunity for collaborative design and research.

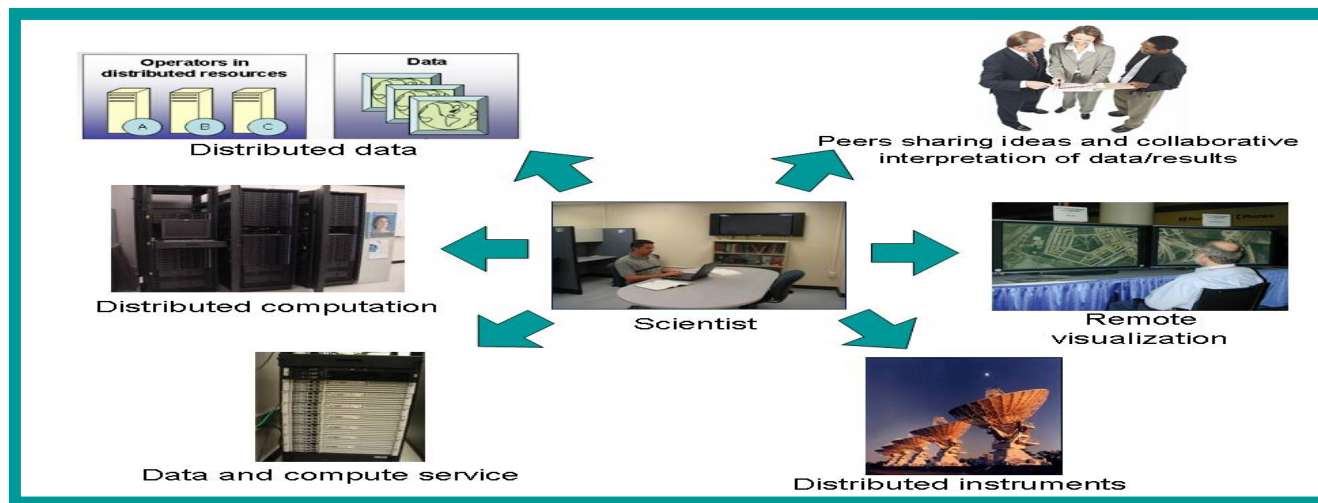


Fig 1. A Typical Collaborative Design and Research Scenario

The [workflow composition of distributed signal processing operators](#) is the [general purpose of this project](#). It targets on the deployment of several operators probably geographically distributed in different domains and developed by different researchers.



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Signal Processing Composition

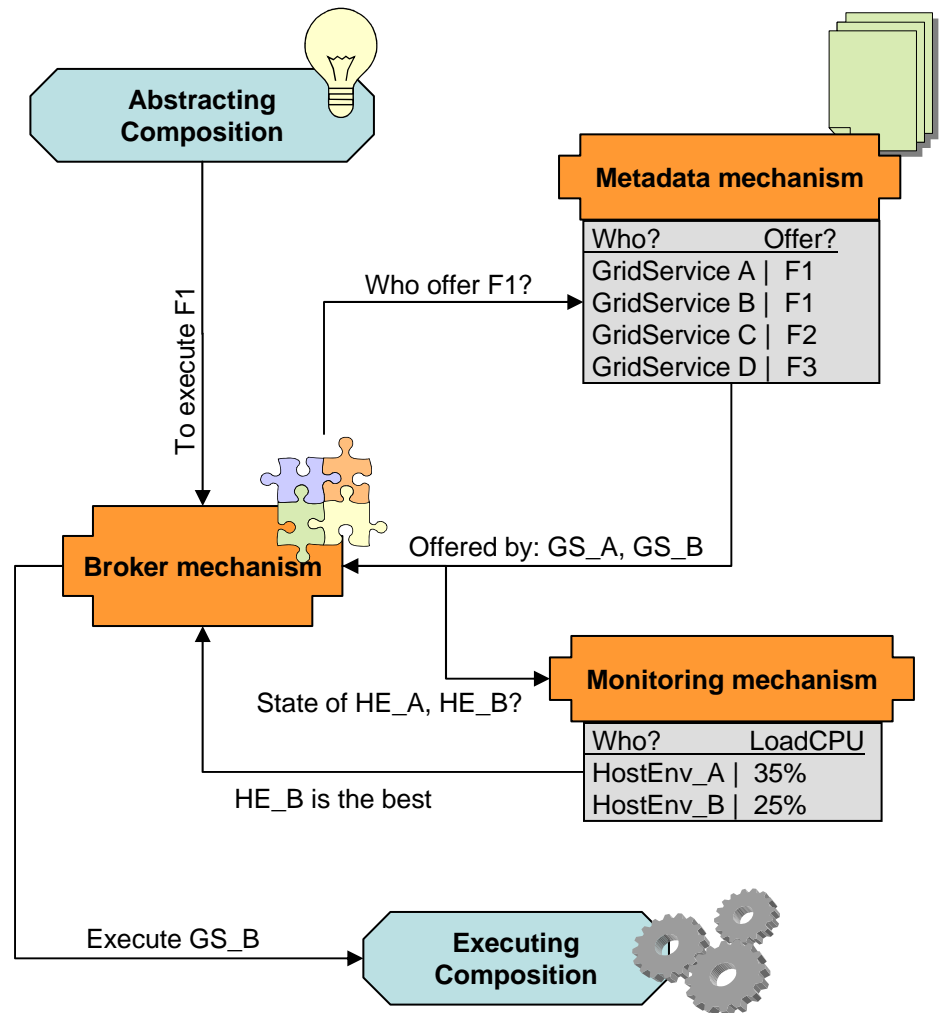
- Solution Formulation -

A **grid system** may have numerous services, some of these offering the same functionality, and when a user needs to realize a task that involve that functionality, the system should be able to decide what service to execute, and give it to the user in a transparent way. The requirements to achieve this functionality are:

- Each grid service must offer sufficient information or **metadata** that involve different aspects such as: inputs o parameters and preconditions, outputs and postconditions, approximate time of execution, minimal resources of computing required, among others.

- The system must have a **monitoring mechanism** to detect and inform the conditions of the resource in which a target grid service is implemented such as: load of CPU, free memory, among others.

- A **broker mechanism** must act as agent that constant consulting the state of the resources for matching with the metadata of grid services required.



HE: Host environment
GS: Grid service
Fx: Functionality offered by a grid service

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 GT4 includes a basic installation of Java WS Core and base grid services such as a security infrastructure (GSI), data transport service (GridFTP), execution services (GRAM), and Information services (MDS). We use GT4 as the technology underlying the tool for composition of signal processing operators.

GridSphere Portal Framework: (<http://www.gridisphere.org>)

The Gridsphere Portal Framework will be used to build reusable portal components that can be integrated in a common portal container system. Gridsphere is based on the notion of a “portlet,” a portal server component that controls a user-configurable pane in the user’s web browser. A portal server supports a set of web browser frames, each containing one or more portlets that provide a user service. This portlet component model allows one to construct portals merely by instantiating a portal server with a domain specific set of portlets, complemented by domain-independent portlets for collaboration and discussion. Using the Gridsphere, one wraps each grid service with a portlet interface, creating a “mix and match” palette of portlets for portal creation and customization. The resultant grid portal will hide the administrative complexity of the application via easy-to-use interfaces.

Java Language: (<http://java.sun.com/>)

We will use Java like object-oriented programming language to implement the signal processing grid services.

Java Advanced Imaging (JAI) API: (<http://java.sun.com/products/java-media/jai/>)

The Java Advanced Imaging API provides a set of object-oriented interfaces that support a simple, high-level programming model to manipulate images easily. We will use this API to execute signal processing operators on images.



Demo Example

WALSAIP Portal

Logout
Welcome, Guest User

PDCLab Home | WALSAIP Home | UPRM Home

Welcome | WALSAIP Portlets

Edge Operator | Blur Operator | Scale Operator

Edge Operator Portlet

From PDC Server (pdcgrid-32-01.ece.uprm.edu)

Operators option

Photo with Operator:

Operated image

Original Photo:

Original image

Show Selection

The screenshot displays the WALSAIP Portal web application. At the top, there is a header with the WALSAIP Portal logo and a navigation bar containing links to PDCLab Home, WALSAIP Home, and UPRM Home. Below the header, there are tabs for 'Welcome' and 'WALSAIP Portlets'. Under the 'WALSAIP Portlets' tab, there are buttons for 'Edge Operator', 'Blur Operator', and 'Scale Operator'. The main content area is titled 'Edge Operator Portlet' and shows two images: 'Photo with Operator' (a processed image with edges highlighted) and 'Original Photo' (a satellite image of a coastline). Callouts point to the 'Operators option' button, the 'Operated image', and the 'Original image'.



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