



IST-2001-32133

GridLab - A Grid Application Toolkit and Testbed

Implementation of Core Adaptation Functionality

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Document Filename:	GridLab-7-CORE-0003-CoreAdaptationFunctionality
Work package:	WP7: Adaptive Components
Partner(s):	Vrije Universiteit (VU)
Lead Partner:	Vrije Universiteit (VU)
Config ID:	GridLab-7-CORE-0003-1.0
Document classification:	INTERNAL

Abstract: This document contains links to the implementation and web site of the core adaptation functionality in the GridLab project





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1 Adaptive Basic Infrastructure

The basic infrastructure that is needed to implement adaptive components is currently available in prototype form. It has also been deployed on the GridLab testbed. The current implementation gathers machine and network information that is needed to solve the use-cases. Moreover, it provides an interface to conveniently access the gathered information. We will now briefly describe the design of the basic infrastructure of the Adaptive system, called the Delphoi system from now on. The Delphoi system consists of three software components: the Delphoi web service frontend that is used to access the data, the Delphoi module itself that contains all intelligence, and a Pythia module which gathers the information.

1.1 Delphoi Web service

The web service frontend provides an interface to query the adaptive system. Its final version will be an OGSA-compliant service, as soon as OGSA has matured and is being used within the GridLab project. Meanwhile, it is a regular Web service.

1.2 Delphoi module

The Delphoi module is the centralized component that contains the intelligence to convert high level requests into low level metrics. For instance, when Delphoi is asked to predict the time it takes to transfer a file from A to B, it knows that the time depends on the network bandwidth between A and B. Next, it will ask the Pythia on machine A what its bandwidth to machine B is. Given this bandwidth, Delphoi predicts the transfer time. Furthermore, Delphoi contains an RMI frontend module. This frontend basically provides the same functionality as the web service frontend (see above). However, RMI is orders of magnitude faster than web services, and does not suffer from the restrictions that are inherent to the web services model. For example, it is possible to transfer Java objects containing complete network graphs annotated with latency and bandwidth with a single call.

1.3 The Pythias

The Pythias are components that are installed on machines throughout the grid. Pythias are internal components in the Delphoi system, and are not exported to the outside. Users of the Delphoi system only use either the RMI or the web service frontend. The Pythias perform all local measurements on metrics like CPU load, disk speed, and network performance. The Pythias use GridLab's Mercury monitoring system to continuously collect data about the resource and applications running on it. This data is processed and may be stored locally for future reference. Since the amount of data transferred between the Pythia and the monitoring system can be large, it is important that they are 'co-located'. Therefore, like the monitoring system, the Pythia generally runs on the resource itself (the frontend machine of a cluster, for example). The Pythia gathers information about the machine (or site) on which it is installed and the about the network connections to other machines. For the GridLab testbed, only a single Pythia installation per site is required. This Pythia will typically run on the frontend machine of a cluster, as a single process on a shared memory machine, or on a stand-alone machine that is 'close' to the machine for which information needs to be gathered (by 'close' we mean that the stand-alone machine uses the same wide-area connections as the 'real' machine, so that any network measurements done to the stand-alone machine are also representative for the

'real' machine). Next to the Mercury monitoring system, the Pythias can use external tools like pathrate, pathchirp, traceroute, etc.

1.4 More Information

For more information, see: <http://www.gridlab.org/WorkPackages/wp-7/design.html>

1.5 Software Download

The prototype of the Adaptive basic infrastructure (the Delhpoi system) can be downloaded from the internal workpackage 7 web page:

<https://www.gridlab.org/Internal/WorkPackages/wp-7/index.html>