Testing and Benchmarking Grid Infrastructures using the g-Eclipse Framework

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On behalf of the g-Eclipse Project

Information Society

Overview

- Grid Reality – The Problem

- g-Eclipse Framework

- The Idea

- Technical Overview

- Tests Framework

- Benchmark Framework

- Future Work

Grid Reality – The Problem

Grid Infrastructures: a huge collection of computational and storage resources.

The [EGEE]* infrastructure in Europe alone has available 24 / 7:

- 267 Sites (in 54 countries)

- ~114,000 CPUs

- 20 Petabytes of disk space.

- Supporting ~ 15 application domains

- **E**nabling **G**rids for **E**-scienc**E**: www.eu-egee.org

eGee
Enabling Grids
for E-sciencE

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Grid Reality – The Problem II
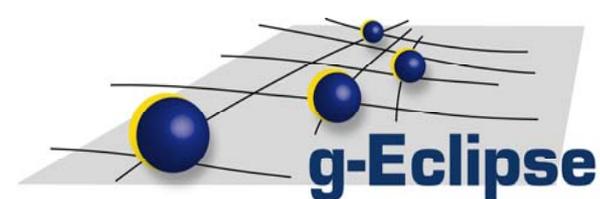
- ## Heterogeneity among Grid Sites
    - Hardware
    - Middleware
    - Application Software

- ## Failures
    - Human (Mis-configuration, Malicious Attacks)
    - Network (Congestion, Faulty network components)
    - Machines (Faulty Hardware components)
    - Other (Power Disruptions, Nature Reasons)
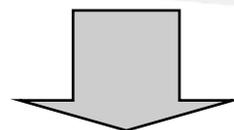
Degradation of the expected Quality of Service (QoS)

Users need to evaluate a priori the resource offerings of different infrastructures and Virtual Organizations (VO).

The g-Eclipse Project

Funded by the g-Eclipse (FP6) EU project

– Duration: July 2006 – December 2008

– Funding: 2 Million Euro

– Consortium members:
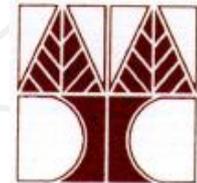
An Open Source Framework

- g-Eclipse is an official Eclipse Technology Project
  - Around 20 developers among the 8 partners
  - 14 members with committer status at Eclipse.org
  - Community established and started to grow.

- Source code released under Eclipse Public License
  - Version 1.0 released in January 2009
  - Roughly 70 plug-ins, 4000 classes and interfaces aka 350.000 LOC
  - Available for free download
  - Supported platforms: Linux, Windows, Mac OS X

g-Eclipse – The Idea

- Provide a friendly UI for accessing Grids.

- Provide an <u>extensible, middleware-independent</u>, framework for accessing Grids.

- Supports the roles of Grid **users**, **developers** and **operators**.

- Provide the necessary tooling to hide the complexity (**wizards, editors, views …).**

- Substitute CLI with GUI.

- Conform to Grid Standards.
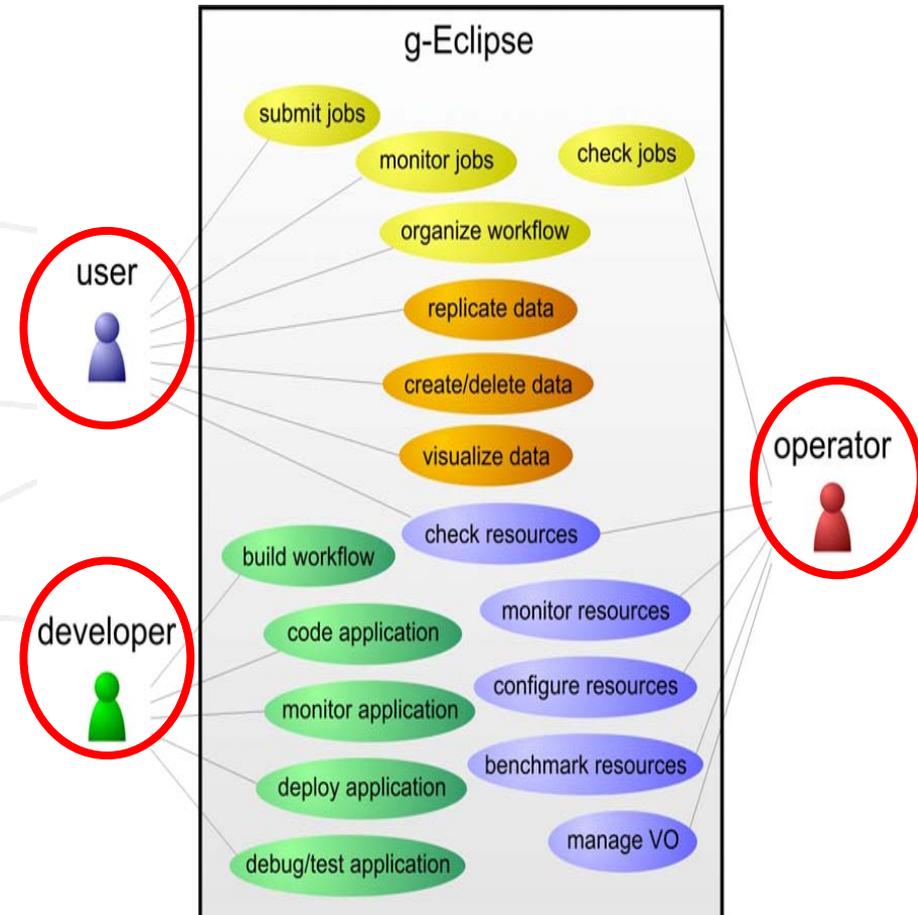
g-Eclipse - Technical Overview

- **g-Eclipse is based on the Eclipse platform**
  - It is modular (OSGi) and extensible (Extension point mechanism of Eclipse).

- **Provide a middleware-independent architecture that:**
  - Abstracts common grid concepts.
  - Provides abstract core functionalities.
  - Is extensible by middleware-specific plug-ins.

- **Provide a graphical user interface that:**
  - Is based on the abstract core and therefore.
  - Looks and behaves (at least) the same for any middleware.

g-Eclipse

Implementation Layer (Middleware)

Abstraction Layer

Core   UI

Eclipse Platform
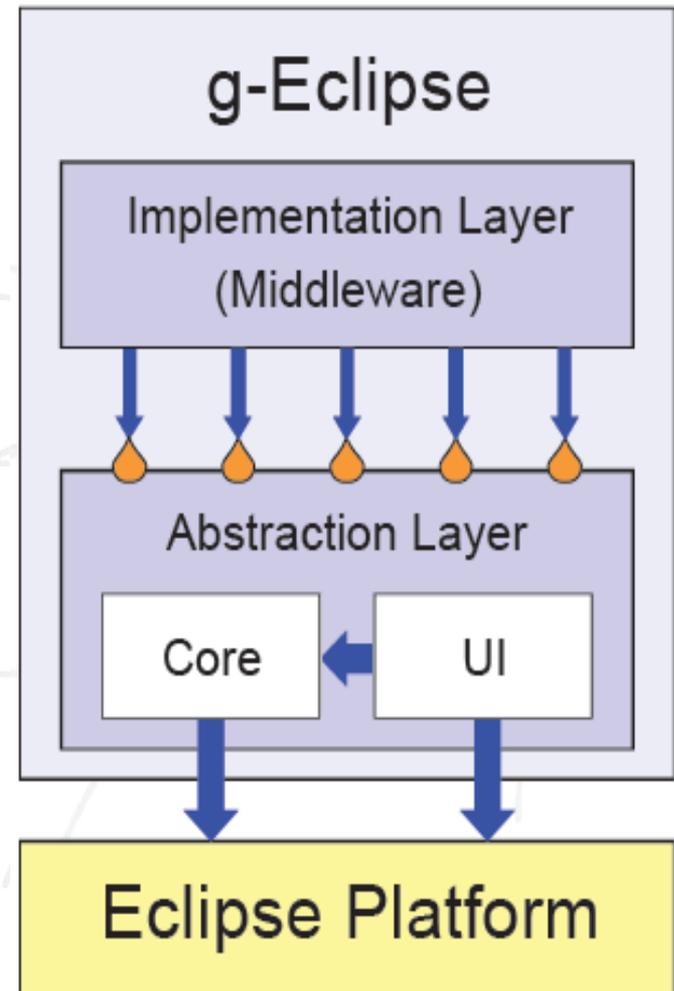
◆ Eclipse Extension Point

g-Eclipse - Technical Overview II

g-Eclipse

VOMS UI	VOMS Authent. Impl.	gLite Middleware UI	gLite Middleware Resource Management Implementation
Authentication UI		Resource Management UI	

Grid Authentication Core	Grid Resource Management Core	Job Management
		Res. Management

Eclipse Platform
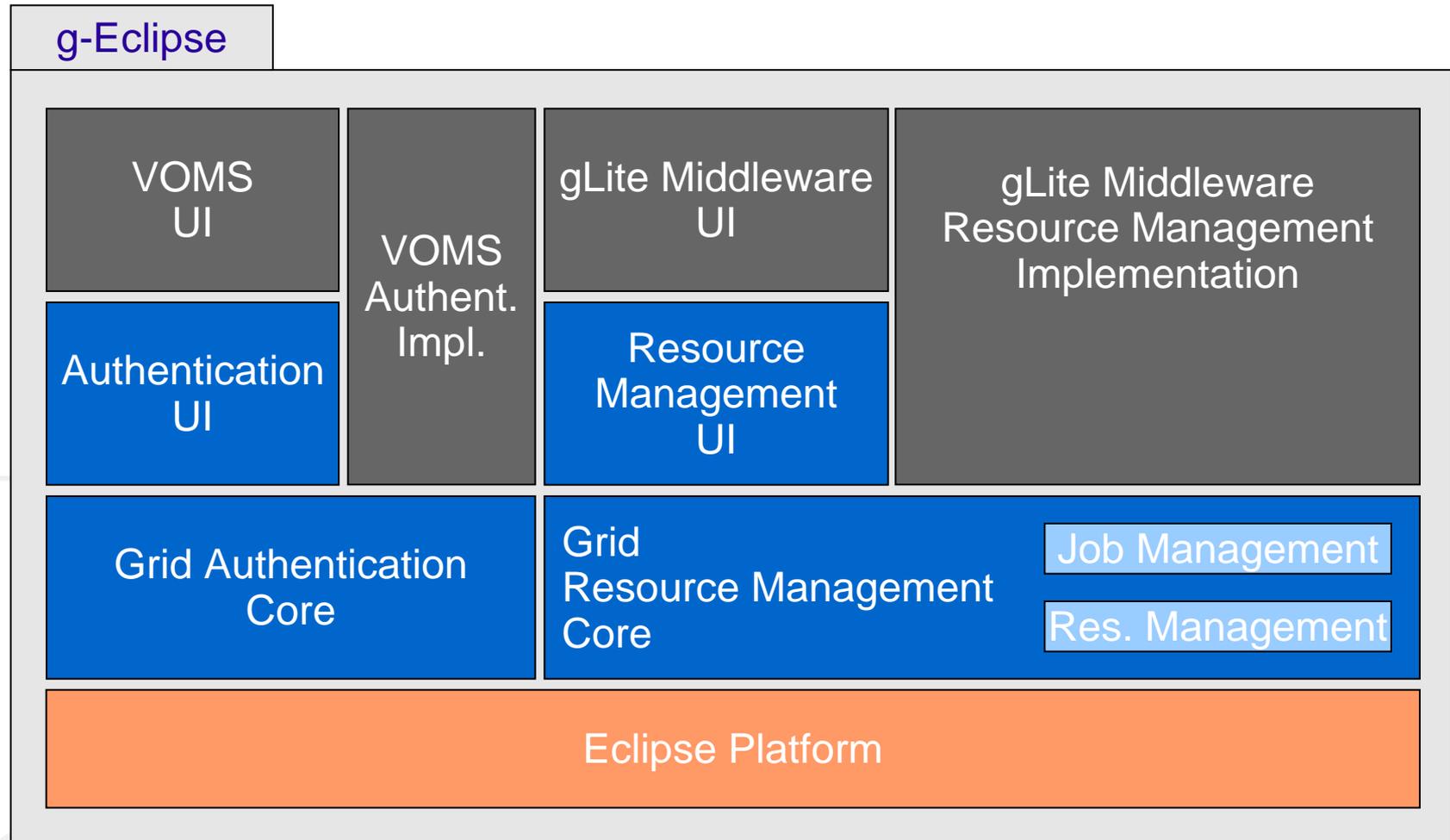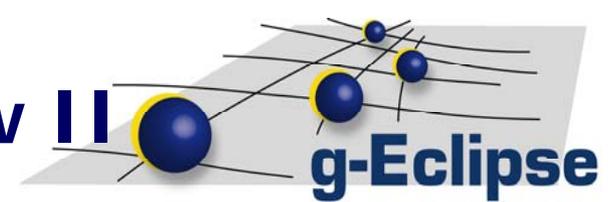
g-Eclipse – Middleware support

Currently supported middleware:

- **gLite** - Batch system for the scientific user.

- **GRIA** - Service-oriented infrastructure for industry and commerce.

- **AWS** adapters for cloud computing.

Use Case

g-Eclipse

Users need to evaluate a priori the resource offerings of different infrastructures and Virtual Organizations (VO).

Tests Framework

Benchmark Framework
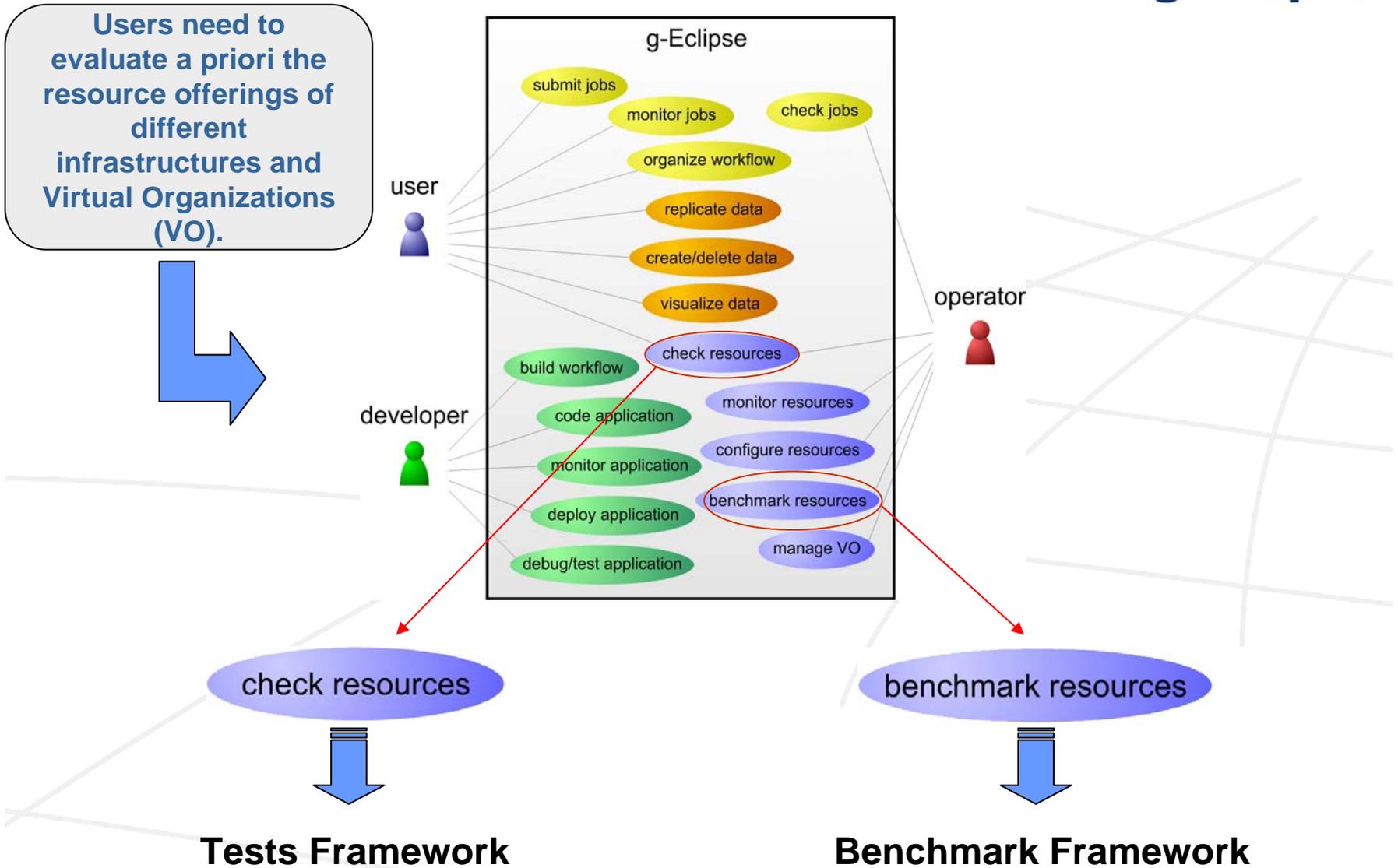
Tests Framework

- The framework provides
  - Simple, on-demand tests to determine if a service is currently up.
  - Complex tests to determine if a service complies with the requirements of users.

- Tests can be performed to one or more resources are categorized to:
  - **Simple Tests**
  - **Structured Tests** (Operators Jobs).

- Simple tests *simply* check if a resource is available.

- Exemplary simple tests are provided:
  - Ping Test.
  - Domain Name Lookup Test.
  - Port Scanner.

Tests Framework II
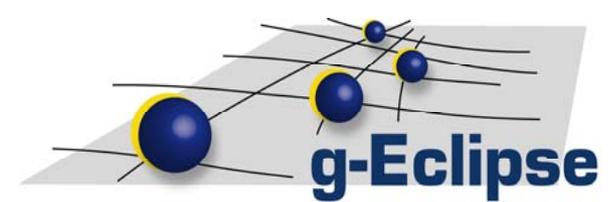
- Structured Tests perform extensive tests that may require the _submission_ of a job.

- Grouped in three categories:
  1. **Direct Tests:** directly tests remote services of a resource using service dependent access protocols
  2. **Submitable Tests:** Must be submitted to an infrastructure. i.e.:
     - Test the configuration of an executing machine
     - Check middleware version
     - Check host certificate expiration
  3. **External Tests:** Accessing an external testing service or database to retrieve results or possibly initiate new tests.
     - SAM service

- Test results and history are stored locally in XML format and can be retrieved at any time.

Benchmark Framework

- Port of **GridBench**[*] to g-Eclipse.

- Allows the Grid User to measure on-demand the performance of selected Grid sites.
  - Performance is measured by applying a known workload (Benchmarks) which might differ among services.

- Allows to compare current results with the history of previous results to observe the current "health" of resources.

- Currently 2 exemplary benchmarks are provided (FLOPS, Bonnie) but the framework is fully extensible for new Benchmarks.
  - Interest by the community - Implementation of new benchmarks is on the way.

[*] http://grid.ucy.ac.cy/gridbench/

Benchmark Framework II

- Grid Benchmarks require submission of a job to a site.

- Benchmarks are wrapped to a single self extractable, self-executable, self-destructible job.
    - Easily created using a guided wizard.

- Benchmark Jobs can be refined through a Grid Benchmark Definition Language (GBDL).
    - A Multi-page form editor is provided.
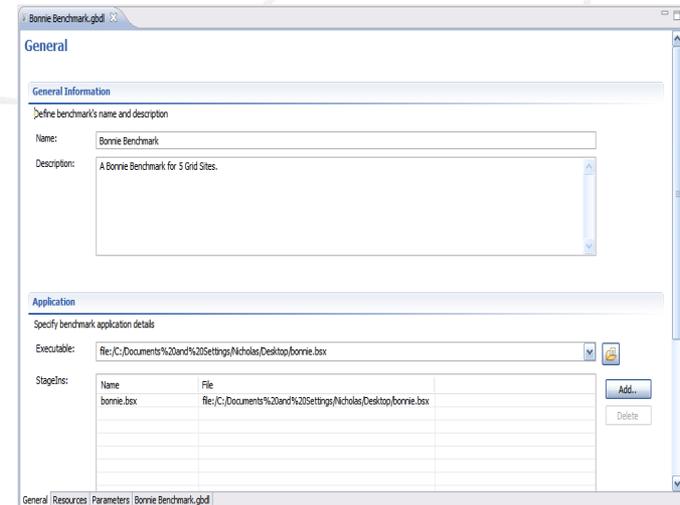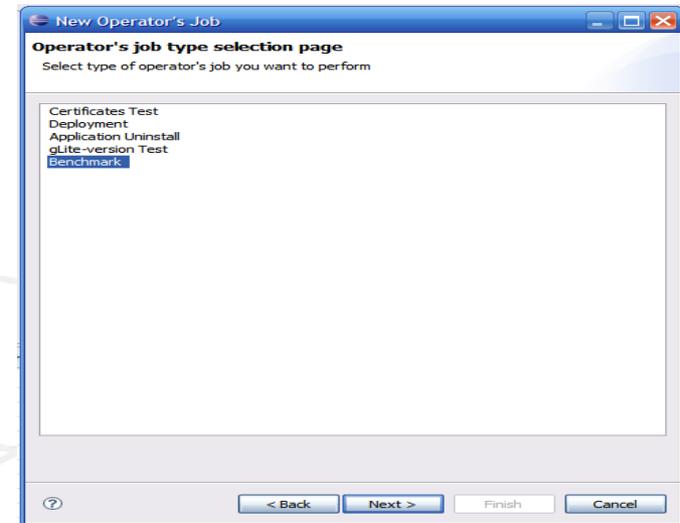
Benchmark Framework III
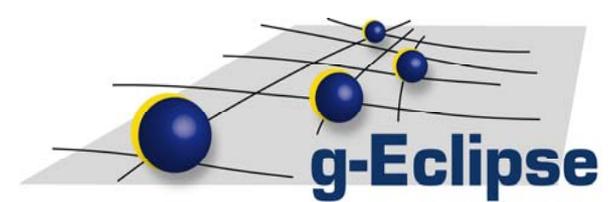
- Ability to monitor the Benchmark job status.

- Benchmark jobs output stored locally in a relational database (Eclipse Derby).

- Database is queried using SQL to retrieve required data.

- Output can be presented in tabular or graphical form.

- Local database import / export functionality.

Future Work

- Tests Framework
  - Extension of Simple and Structured tests.

- Benchmark Framework
  - Implementation of additional Benchmarks to reach completeness of GridBench.

  - Ability to rank sites adaptively based on current and previous benchmark results.

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Contact the g-Eclipse Team.

Thank you for your attention.

For more information visit:

http://www.eclipse.org/geclipse
http://www.geclipse.eu

Or contact the:

g-Eclipse User Mail List: **geclipse-user [at] eclipse.org**

g-Eclipse Development Mail List: **geclipse-dev [at] eclipse.org**