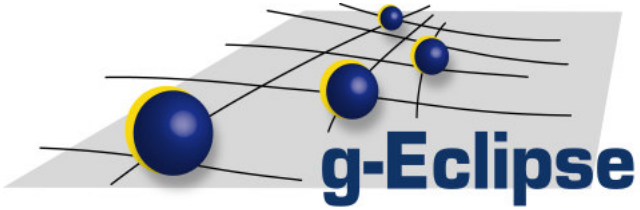
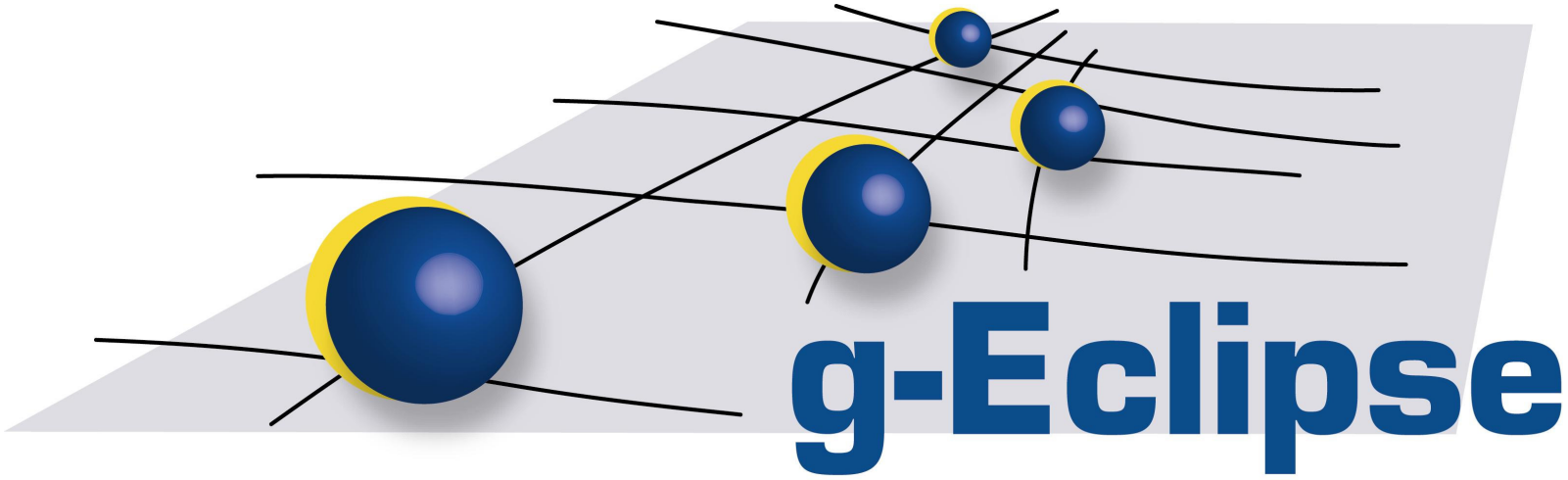



# Easy Access to Grid Infrastructures

Dr. Harald Kornmayer (NEC Laboratories Europe)

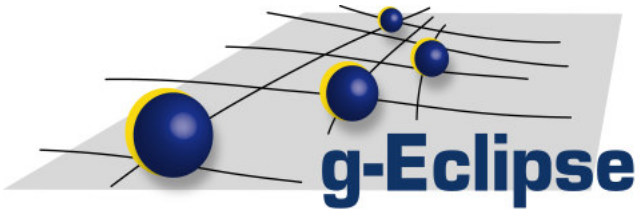
On behalf of the g-Eclipse consortium

WP11 Grid Workshop

Grenoble, France

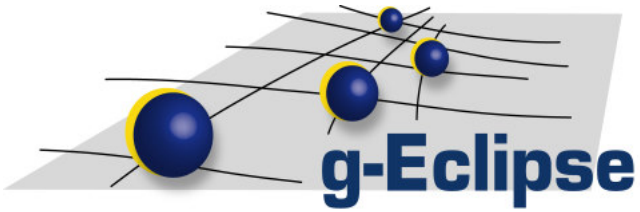
09th of December 2008

# About me!



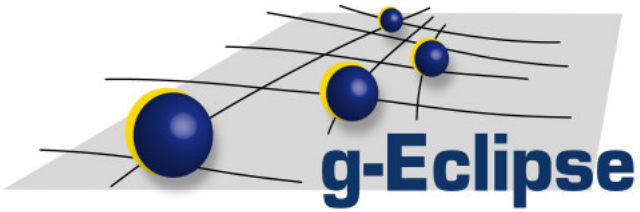

- Background in astro particle physics
- 2001: Build a Risk Management system (SOA with JAVA)
- Forschungszentrum Karlsruhe:
  - 2003: CrossGrid
  - 2004: EGEE
  - 2006: D-Grid
  - 2006: g-Eclipse
- Since 2007:
  NEC Laboratories
  - IT Research Group

# g-Eclipse – the idea




- Users want easy access to the system
- Users act within different roles
  - Grid applications users
  - Grid resource providers and operators
  - Grid application developers
- Users are middleware agnostic
  - → Build a middleware independent framework
- Provide a general UI framework/eco system for the different Grid actors based on a reliable platform
  - → (re-)use Eclipse and contribute!
  - → gain OS independence (by using JAVA!)

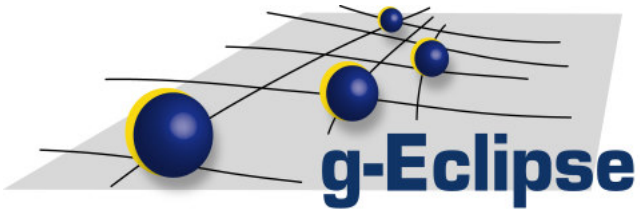
# Eclipse




- Started in 2001
  - IBM donated their Java development framework as Open Source
  - Pure Java development
  - First industrial partners joined


- Eclipse Foundation started in 2004
  - Independent non-profit organization
    - Eclipse management organization
    - Councils (requirements, architecture and planning)
    - 10 projects (including > 50 subprojects)
  - With Eclipse 3.0 not only a Java IDE, but a general framework build for extension

# Can we learn from others?

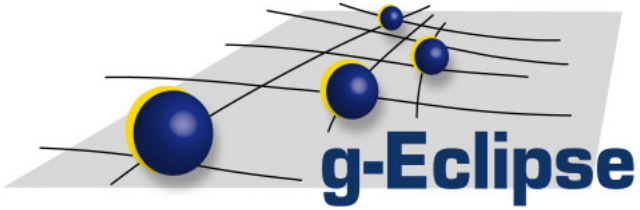



- Are there other distributed systems supported by different middleware systems?
  → J2EE
  - (enterprise beans, JMS, web services, …)
- Based on specifications
  - implemented by different Vendors
    - Websphere, BEA, Oracle, JBoss, Geronimo, …
- Customers don't want to be vendor dependent
  - Use a generic middleware independent development tool

→ Web Tools project (WTP) at Eclipse.org


  - www.eclipse.org/webtools
  - Wizards, Editors, etc to simplify the development of Web applications
  - Independent on the underlying infrastructure

# g-Eclipse – projects




- www.geclipse.eu
- Project funded by the European Commission (INFSO-32347)
- 8 partners



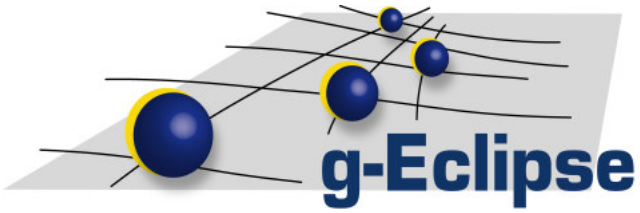




- Until December 2008

- www.eclipse.org/geclipse
- Technology project at Eclipse Foundation
- Release 1.0.0 with stable API scheduled for next week (December 2008)
- Gathering community
  - i.e. in Grid communities
  - In Eclipse community

# The reality for the Grid user



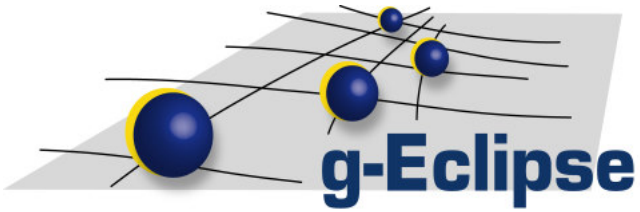

- Infrastructure for scientists were built in the past years
- Many application domains start using Grid infrastructures
- But…
  - Grid technology is complex
    - Different middleware systems are used
      - gLite, Globus, GRIA, UNICORE, …
  - **Different programming paradigms**
    - Batch type systems vs. service oriented systems
    - Many programming languages

→ The threshold is too high for the “standard” user!

# Grid application life cycle

- In most cases, e-Users (e-Scientists, e-Engineers, e-Stock Traders) have their application(s)
  - Legacy code written in different languages (FORTRAN, C, C++, …)
- e-Users want to collaborate
  - A Virtual Organisation is build around a Virtual Computing Center on existing (and new) infrastructure
- e-Users create Grid projects
- e-Users want to interact with the Grid
  - without knowing all details!! (development, deployment, testing, management, …)
- → Tooling is necessary!!
  - Wizards, Editors, …
  - Hide the complexity!!

# Grid Middleware




- Connects resources (computing, storage, (network), . at different sites to one Grid infrastructure
- Provides services to access an infrastructure
- Common basic functionalities of middlewares:
  - Security layer for authentication and authorization
  - Transfer protocols for accessing and managing data
  - Brokers to distribute computing jobs on the infrastructure
  - Higher level services (SLAs, accounting, ...)
- Many different middlewares are available:
  - gLite, Globus Toolkit, UNICORE, GRIA, ...
- g-Eclipse supports

gLite

the globus toolkit

UNICORE

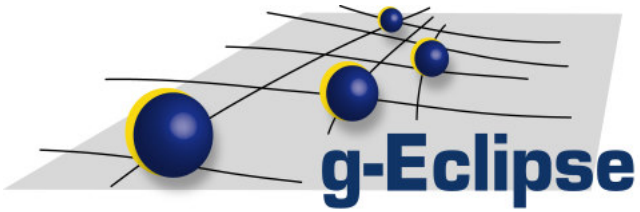
GRIA

gLite

GRIA

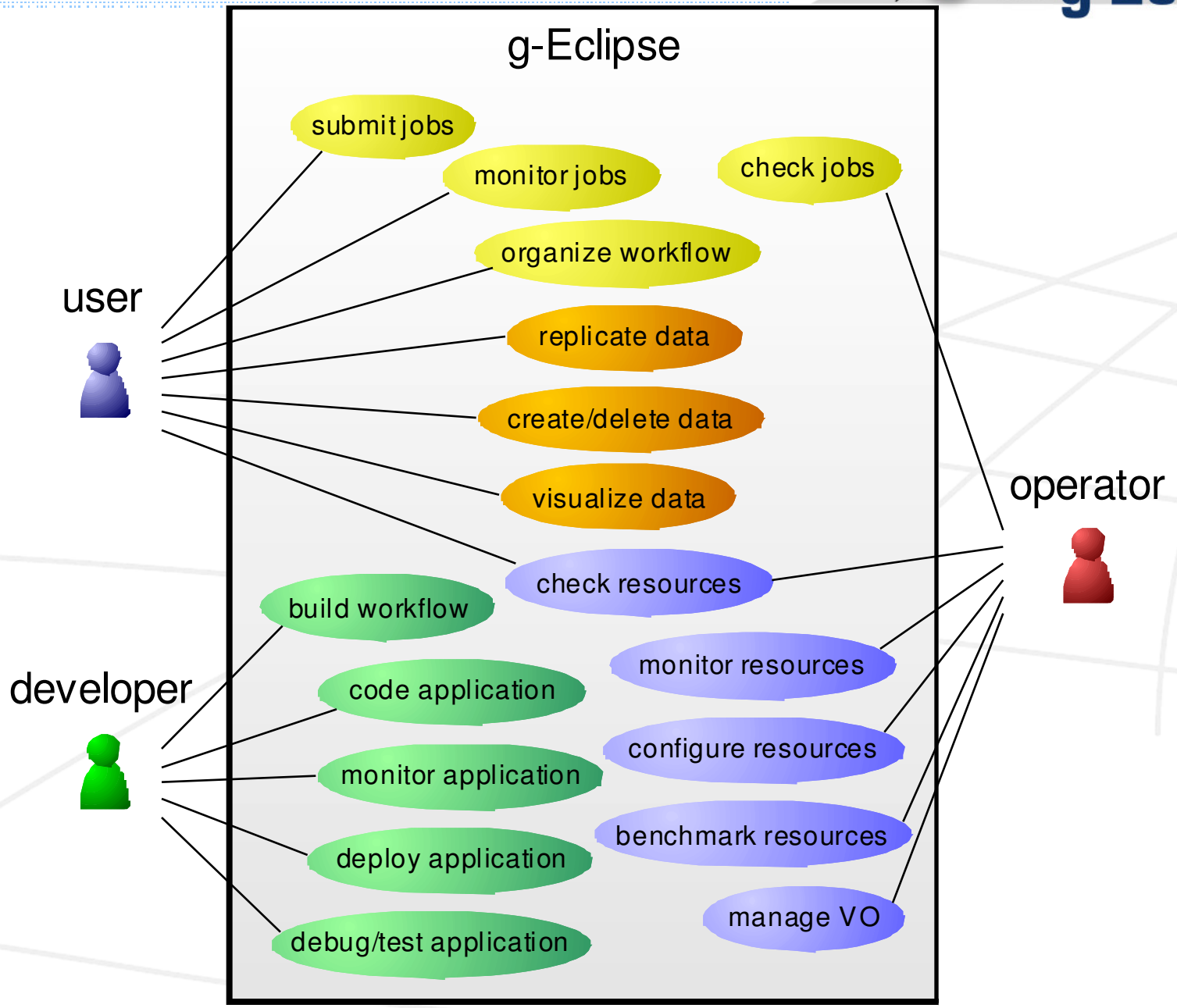
amazon web services™

# Demo 1

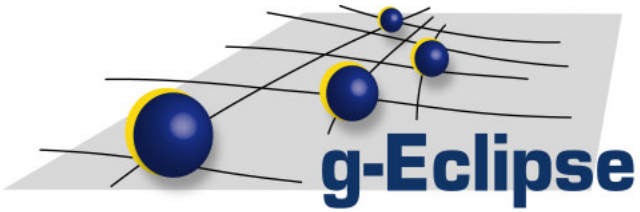



- Just use Amazon
- Create a Grid project
  - Including a VO
- Access to data
  - Edit a file remotely
- Rent a machine in a few seconds
  - Login there

# Use cases


g-Eclipse
submit jobs
monitor jobs
check jobs
organize workflow
user
replicate data
create/delete data
visualize data
operator
check resources
build workflow
monitor resources
developer
code application
configure resources
monitor application
benchmark resources
deploy application
manage VO
debug/test application

# Roles and Contexts



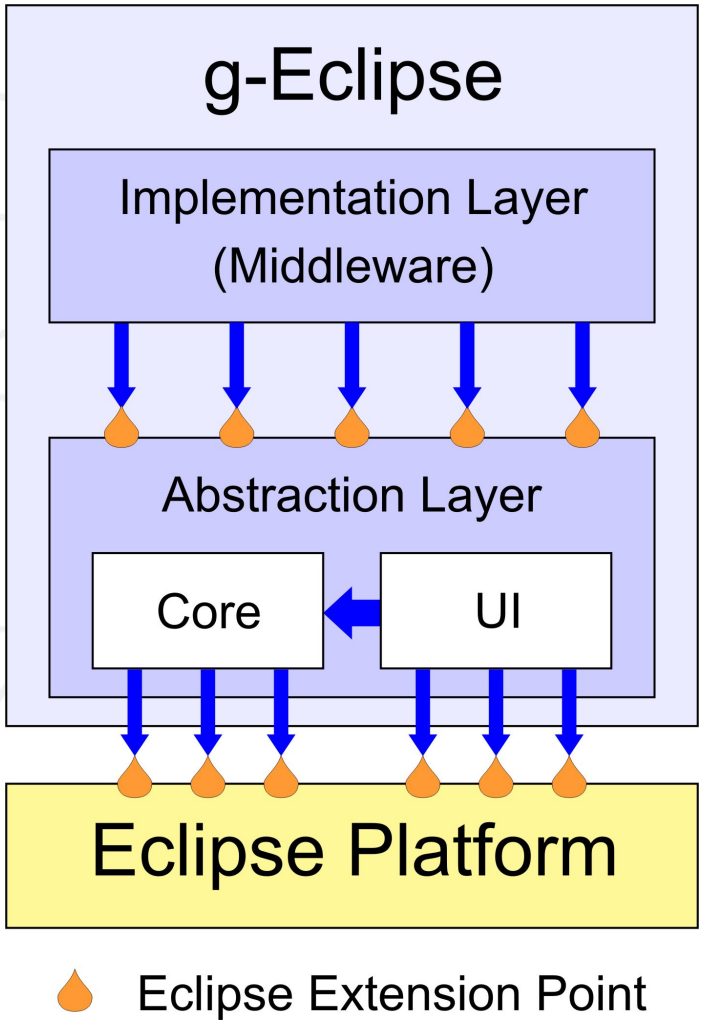

- Grid user plays different roles
  - Grid applications user
  - Grid resource provider and operator
  - Grid application developer
  - ….
- Grid user acts in different contexts
  - Virtual Organizations
  - Projects
  - …

- g-Eclipse supports "Contextualization"
  - Depending on the user role/context a different set of tools is used by/presented to the user
- g-Eclipse supports "Customization"
  - Build the user-preferred workbench
  - Persistent over sessions

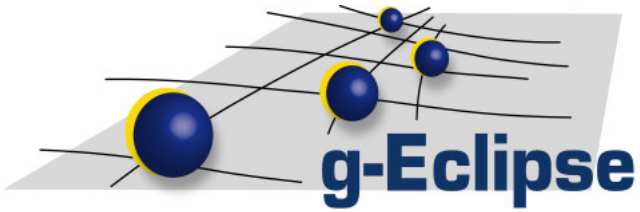
# The Architecture

- Two layers:
  - Abstraction layer (Grid model):
    - Authentication/Authorization
    - Job management
    - Data management
    - Services
    - ...
  - Implementation layer:
    - Implements the model for specific middlewares/Grids
- UI is based on abstraction layer

  →UI looks the same for all middlewares



# Grid project




Resource Broker

Replica Manager

Computing

Storage

Infrastructure

Programming languages

Applications

**Grid project**

Domain services

Batch apps

Infrastructure Providers

Policies

Interactive apps

Virtual Organisations

Service Providers

Workflows

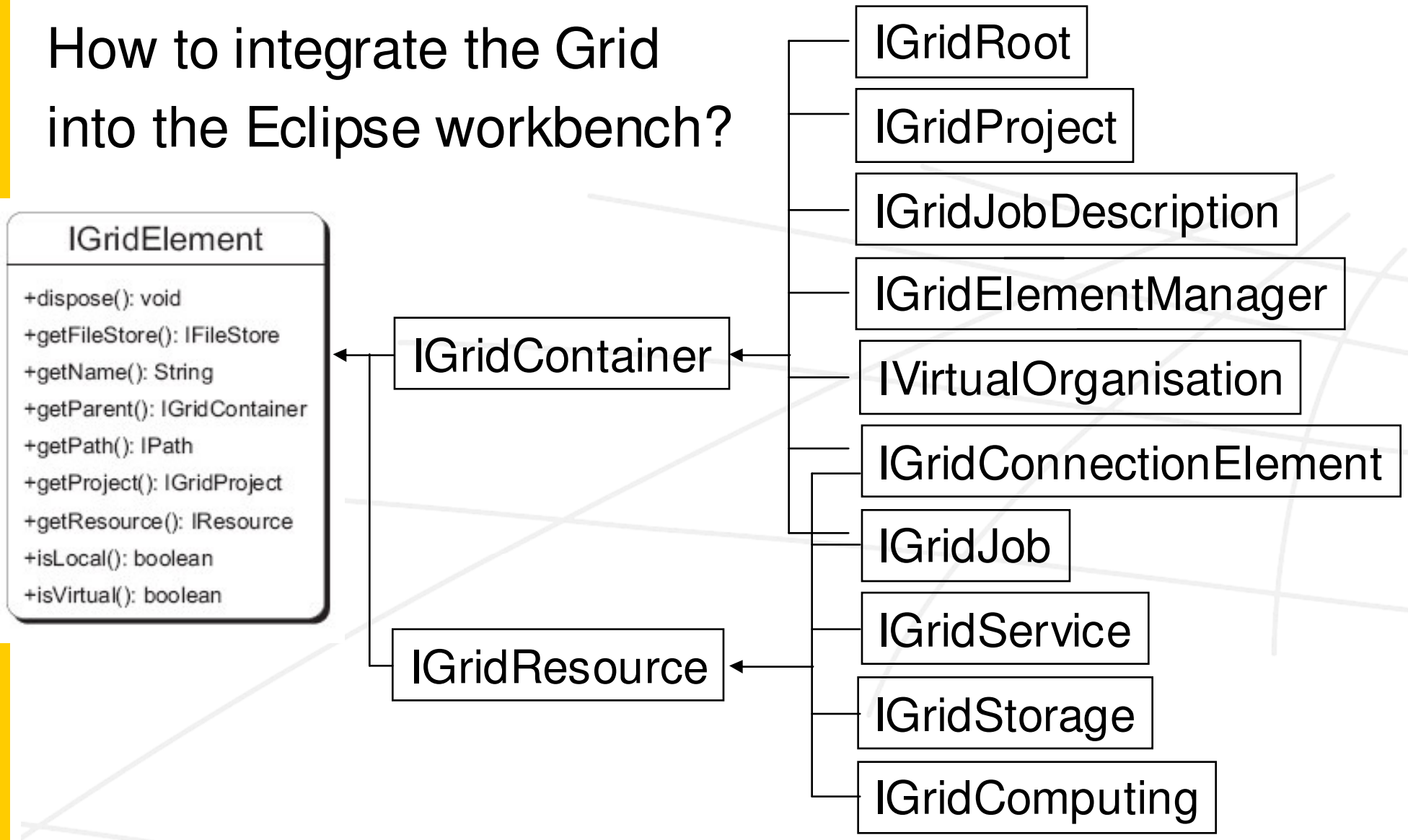
Members

Roles

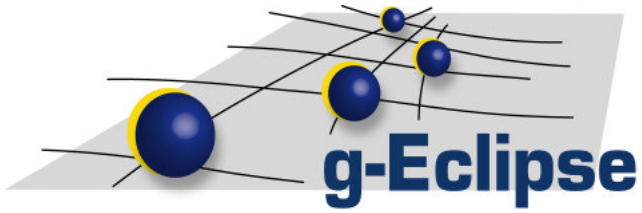
Web services

# Grid Model

How to integrate the Grid into the Eclipse workbench?



# Structuring the Grid




Mounted File Systems

Virtual Organisation

Computing Elements

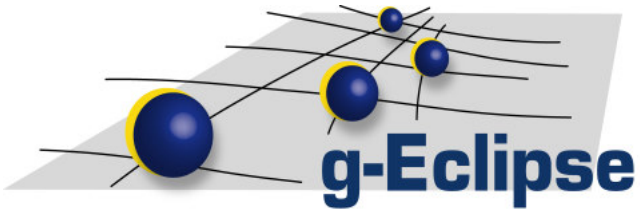
Services

Storage Elements

- MyGridProject
  - Connections
    - Linz
    - Poznan
  - Job Descriptions
    - MyJSDL.jsdl
  - Jobs
    - .MyJSDL.job
      - MyJSDL.jsdl
  - Workflows
    - MyWorkflow.workflow
  - geclipse
    - Computing
      - CE @ a01-004-128.gridka.de:2119/jobmanager-pbspro-geclipse
      - CE @ ce-1-fzk.gridka.de:2119/jobmanager-pbspro-geclipse
      - CE @ ce-2-fzk.gridka.de:2119/jobmanager-pbspro-geclipse
      - CE @ ce-fzk.gridka.de:2119/jobmanager-pbspro-geclipse
      - CE @ ce.egee.man.poznan.pl:2119/jobmanager-lcgpbs-geclipse
      - CE @ ce101.grid.ucy.ac.cy:2119/jobmanager-lcgpbs-geclipse
      - CE @ egee-ce1.gup.uni-linz.ac.at:2119/jobmanager-pbs-geclipse
    - Services
      - Info Services
        - BDII @ ldap://bdii101.grid.ucy.ac.cy:2170
      - Job Status Services
      - Job Submission Services
        - WMS @ https://wmslb101.grid.ucy.ac.cy:7443/glite_wms_wmproxy_server
      - Other Services
    - Storage
      - SE @ egee-ce1.gup.uni-linz.ac.at
      - SE @ gridka-dCache.fzk.de
      - SE @ plethon.grid.ucy.ac.cy
      - SE @ se1.egee.man.poznan.pl

# User perspective

# Demo 2




- Just use EGEE
- Create a Grid project
  - Including a VO
- Access to data
  - Edit a file remotely
- Rent a machine in a few seconds
  - Login there

# Grid Resource Provider

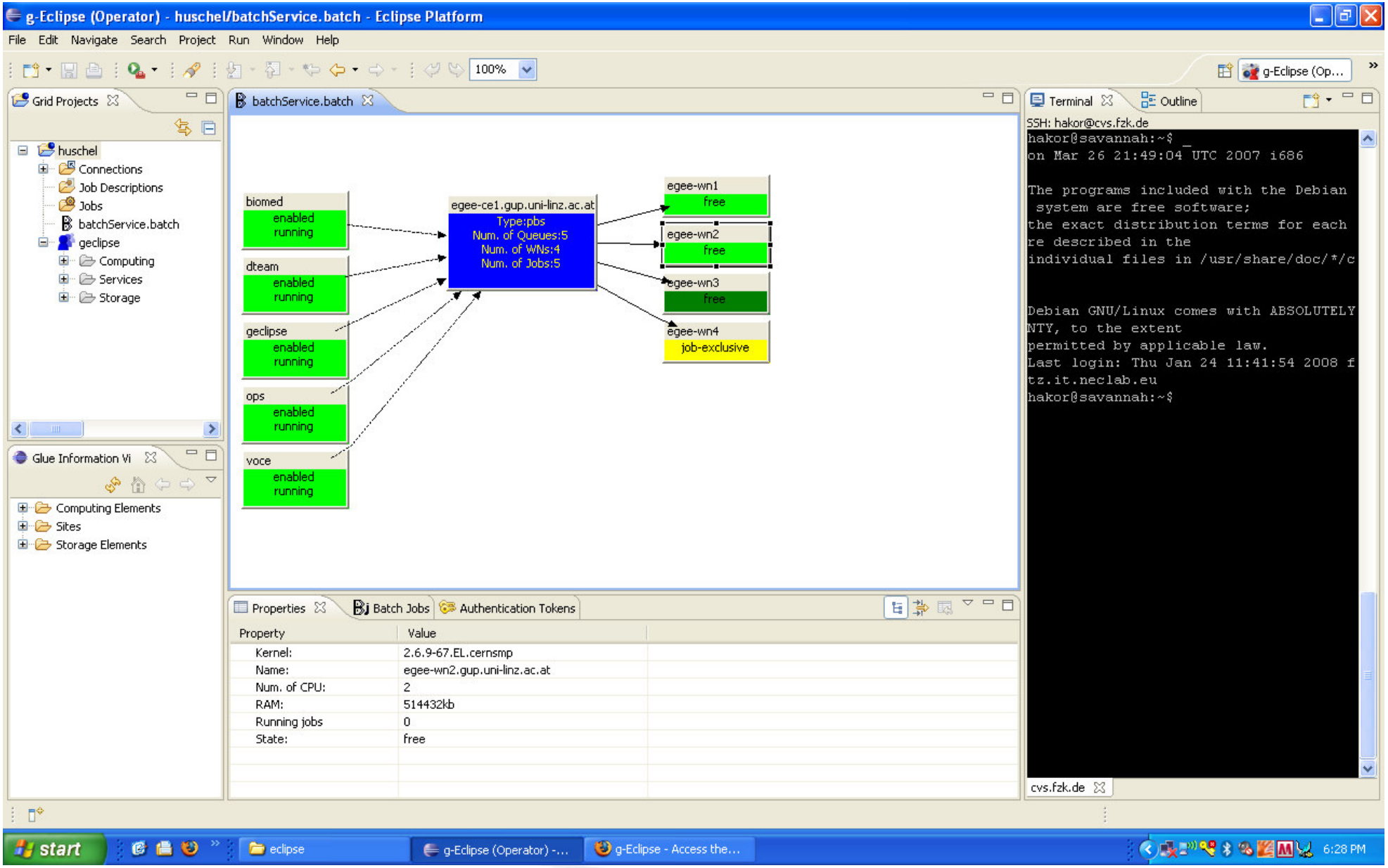
- How can a site A support a new VO with computing resources?

  Set up a queuing system:
  - Old: Know all the details of the queuing system

```
                                                        0     0
[root@ce201 root]# qmgr -c 'create queue test2 queue_type=executi
on" ; qmgr -c 'set queue test2 resources_max.walltime=40:00:00" ;
 qmgr -c "set queue test2 resources_max.cput=72:00:00" ; qmgr -c
"set queue test2 acl_group_enable=true" ; qmgr -c "set queue test
2 acl_groups= +see'
[root@ce201 root]#
```

  - New: Configure the batch system on site with g-Eclipse
    - Set up a VO specific queue
    - Drain queues
    - Manage Cluster nodes

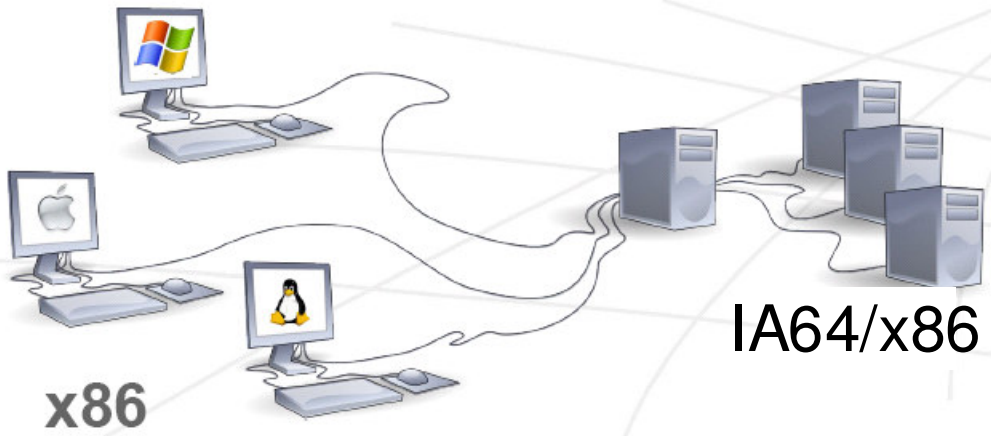
# Operator perspective



# Grid Application development

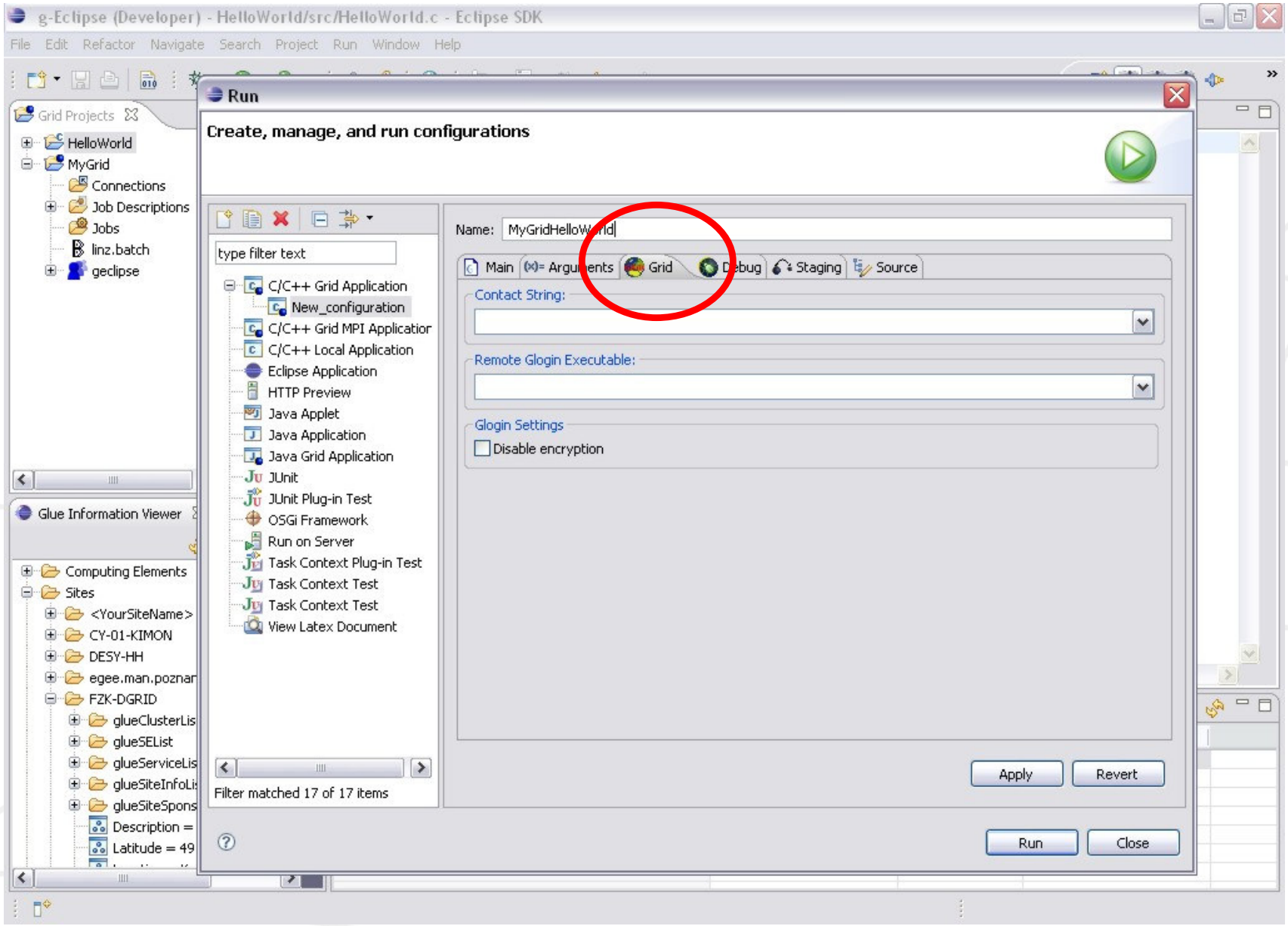
How to “gridify” a Legacy application?

1. Develop them on your local computer as a separate JDT/CDT project
2. After a code change, compile them locally and on a remote Grid resource
3. (if needed debug them locally or on a remote Grid site)
4. Deploy the application

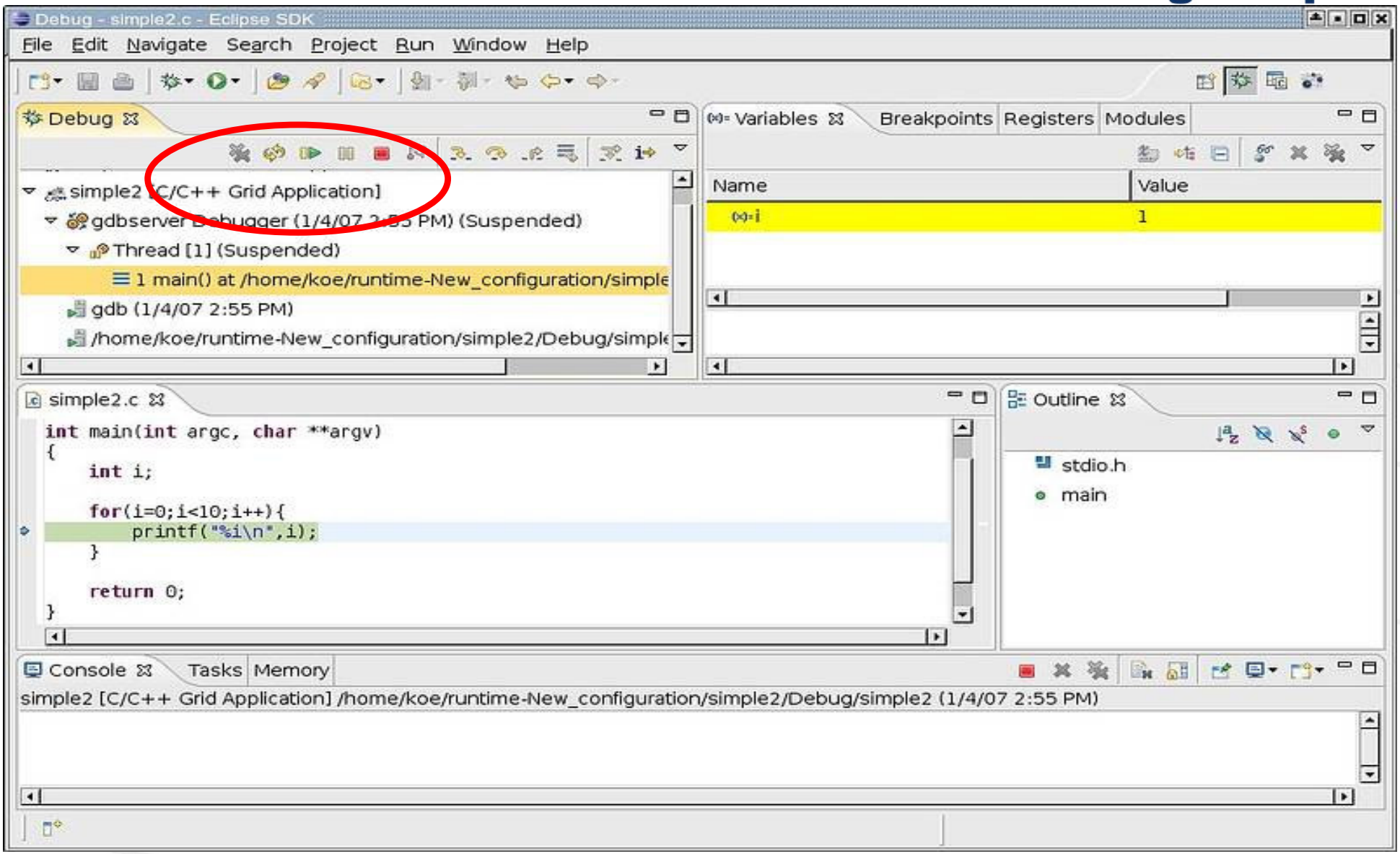



Usage of gLogin introduce some firewall issues!!!

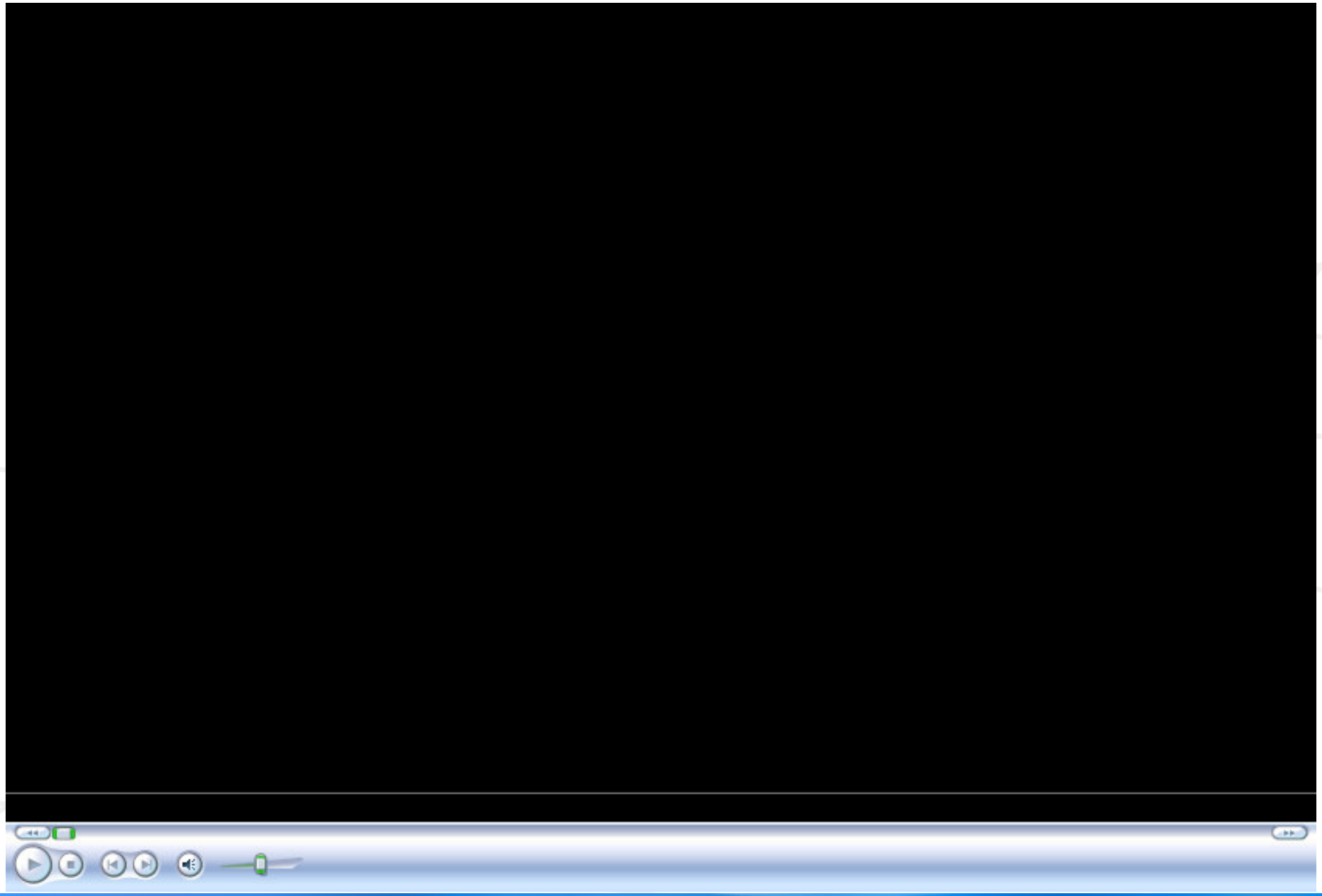
# Developer perspective



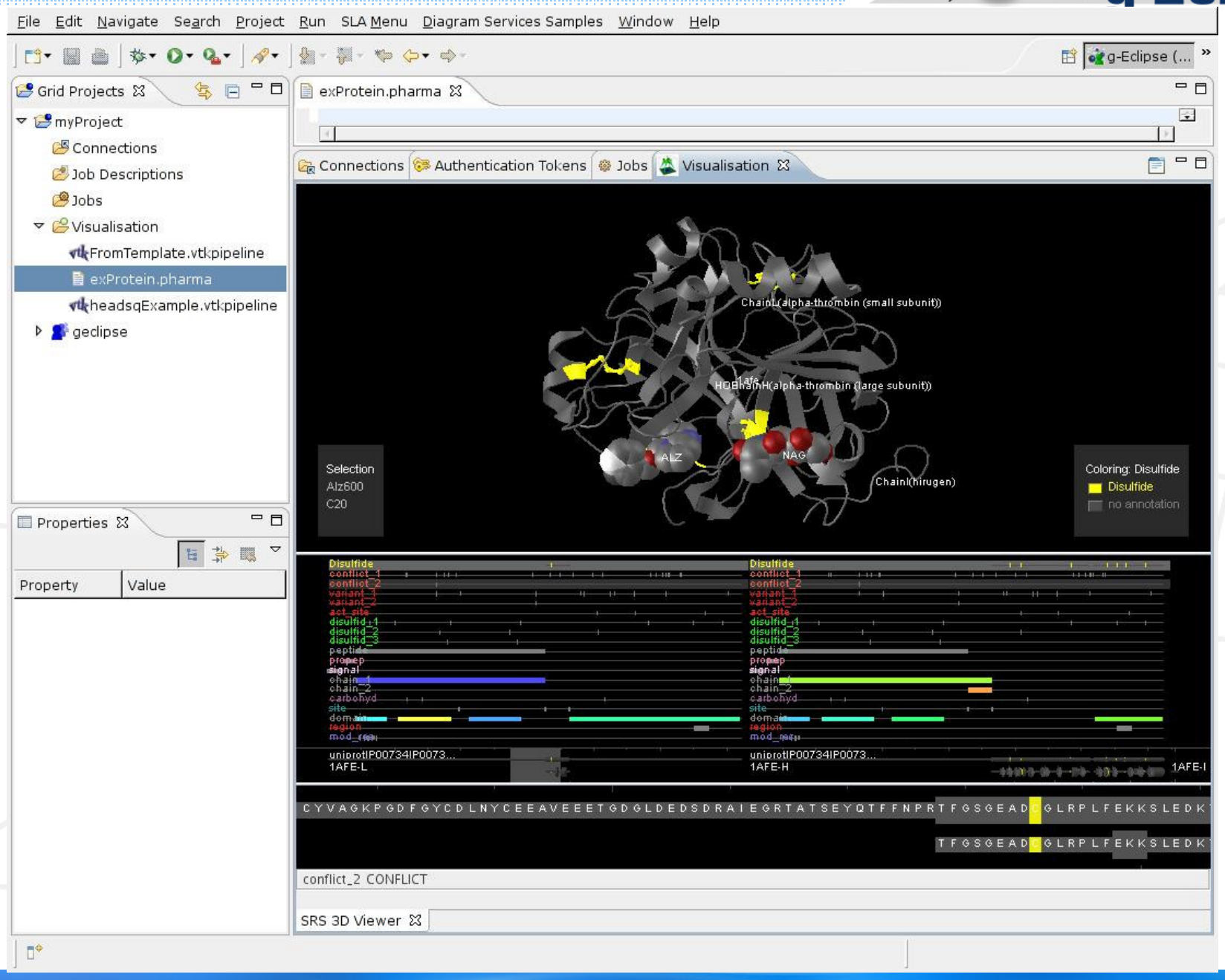
# Developer perspective II



# Visualisation

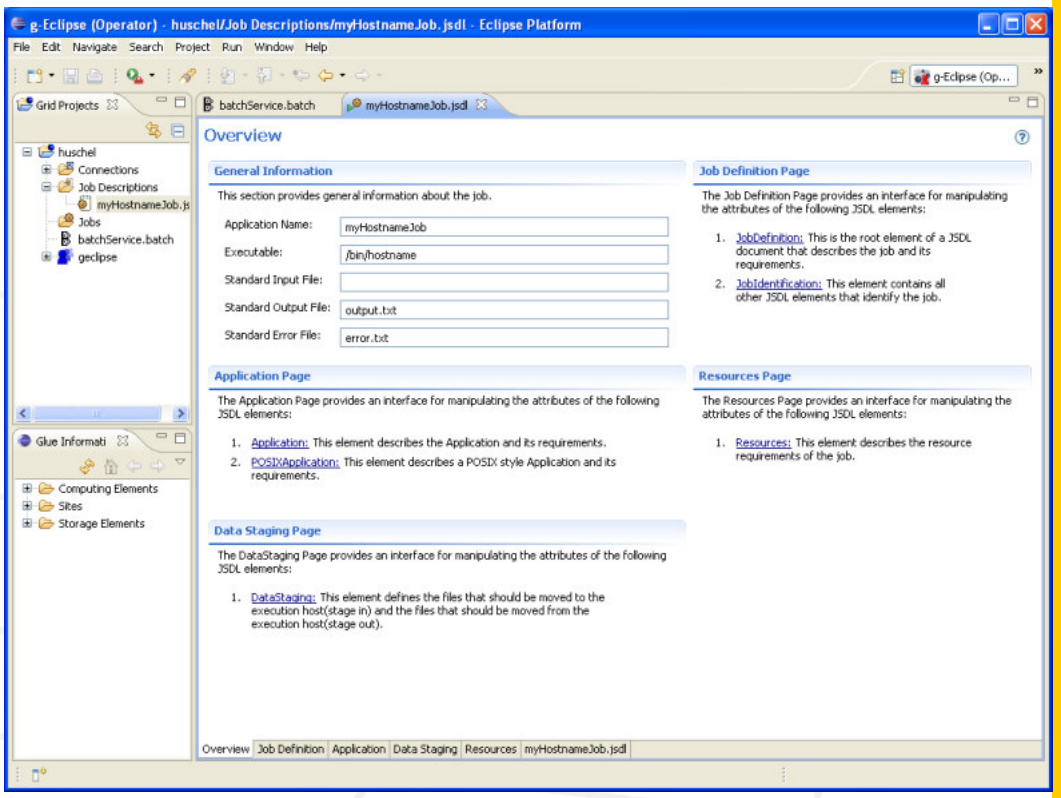


# Visualisation



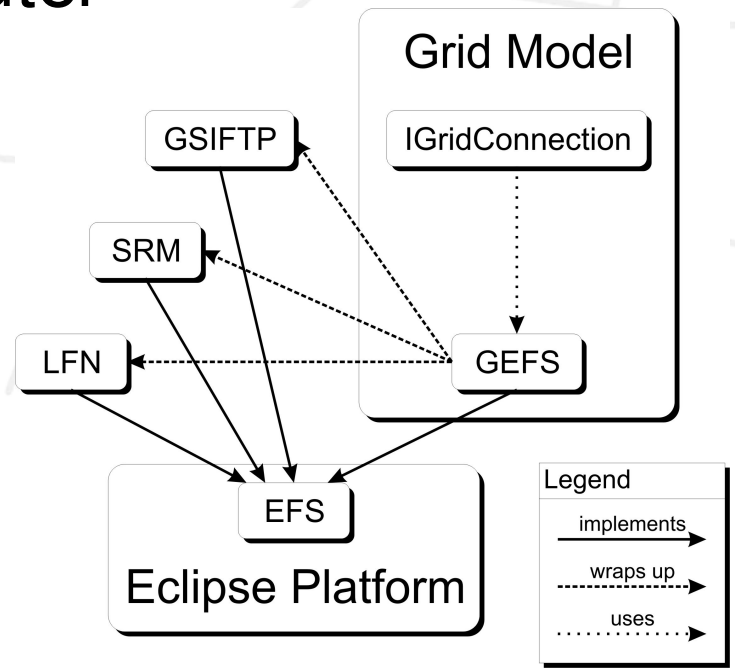
# Standards

- JSDL editor
  - Mulitpage editor following the OGF JSDL standard
  - Submission to different middleware possible
    - gLite: XSLT transformation
- GLUE schema browser
  - Browse through your resources
- Eclipse is based on OSGi
  - Enables dynamic code deployment



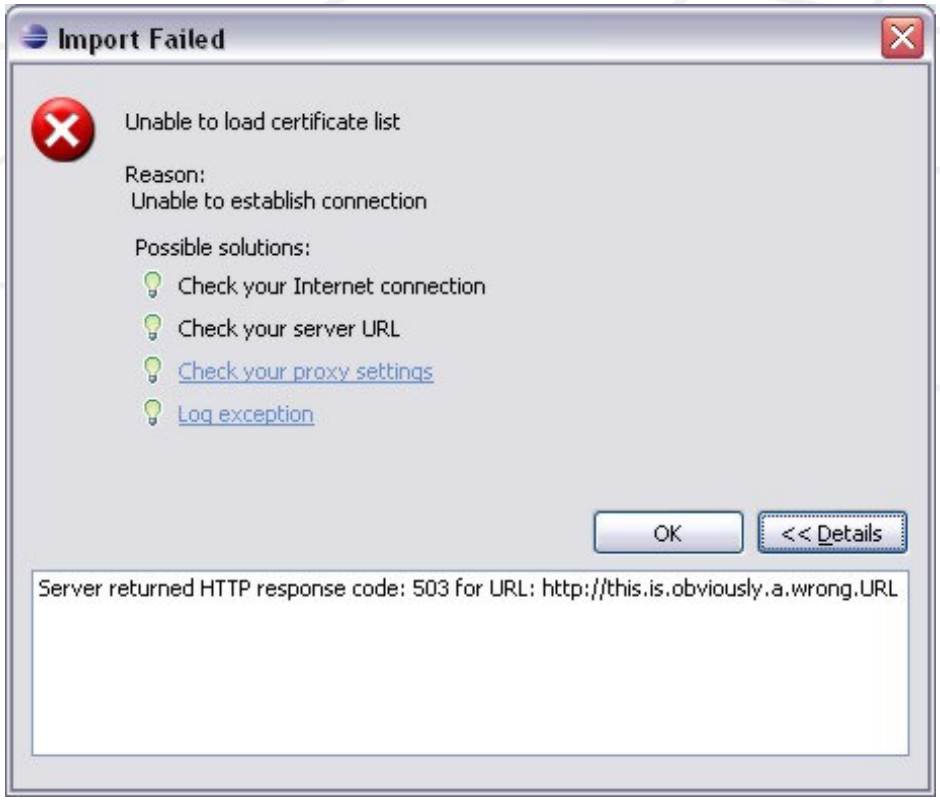
# Interoperatiblity

- g-Eclipse workspace can contain project with different Grid flavors
- g-Eclipse Authentication framework manage the “single sign on” on request
- g-Eclipse enables transfer from/to different Grid flavors and from/to local computer
  - By using the EFS (Eclipse Files System) implementation

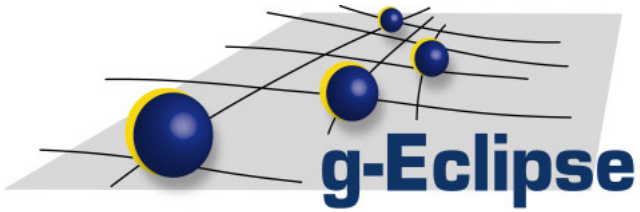


# Manage Complexity

- By providing solution to common problems on Grid infrastructures
  - g-Eclipse provides an extended problem reporting mechanism based on the Eclipse core exception
  - Problems have associated solutions
  - Solutions may be
    - passive: just a descriptive text
    - active: provide an action that helps the user to solve the problem, e.g. open an associated preference page



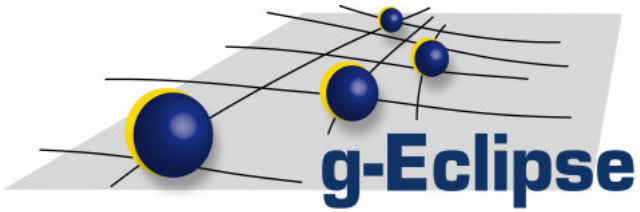
# Current project status




- g-Eclipse is an official Eclipse Technology Project
- First release (0.5) available since September 2007
- Currently working in 1.0 milestone phase (RC3 available)
- Final 1.0 release planned for December 2008

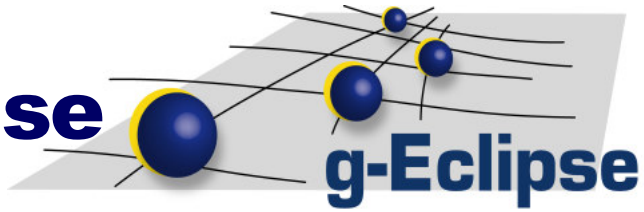
- Architecture and Grid model stable since mid of 2007
- First middleware implementation (gLite) stable since end of 2007
- Second middleware implementation (GRIA) started in the beginning of 2008
- Third middleware implementation (AWS) started in Spring 2008

# User communities



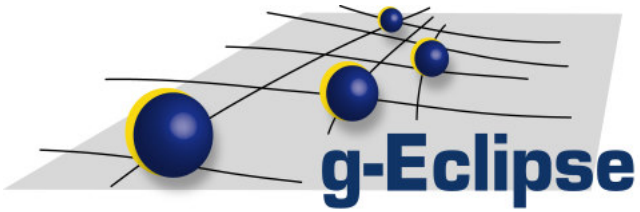

- Interest from many other project
  - Contact with China for GT4 implementation
- g-Eclipse will be used for university lecture in Romania
- Collaboration with other EC projects
  - i.e. SIMDAT, EGEE, DORII, IS-ENES, …
- Collaboration with other Eclipse projects
  - Parallel Tool Platform (support for MPI on HPC resources)
  - SOA Tool Platform
  - Swordfish Runtime

# Short summary for 1.0 release




- Finish second middleware implementation
  - →Prove of middleware independent conception
- Implement some first industry relevant applications on top of g-Eclipse
  - →BAE application for fluid dynamics
  - →Pharmaceutical application by NEC
- Provide an interface for Amazon's EC2 and S3
  - →Be not only middleware-independent but also Grid-independent
  - →Introduce the world of cloud computing in Eclipse

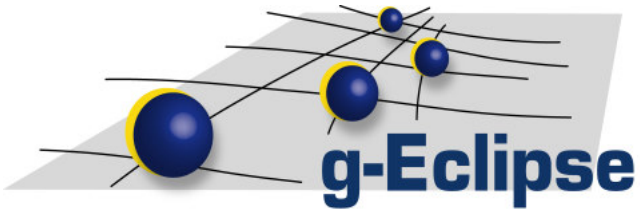
# Contribute




- Use our tool and send us feedback!
  - We do it the Eclipse way!
  - Webpage www.eclipse.org/geclipse or www.geclipse.eu
  - Newsgroup
    - http://dev.eclipse.org/newslists/news.eclipse.technology.g-eclipse/
  - Developer mailing list
    - https://dev.eclipse.org/mailman/listinfo/geclipse-dev
  - Bugzilla
    - https://bugs.eclipse.org/bugs

- Bring your application!!!!
  - Contact {at} geclipse.eu

# Outlook – g-Eclipse




- g-Eclipse has the potential to become as fundamental on the Grid scientist's desktop as the web browser was for the internet

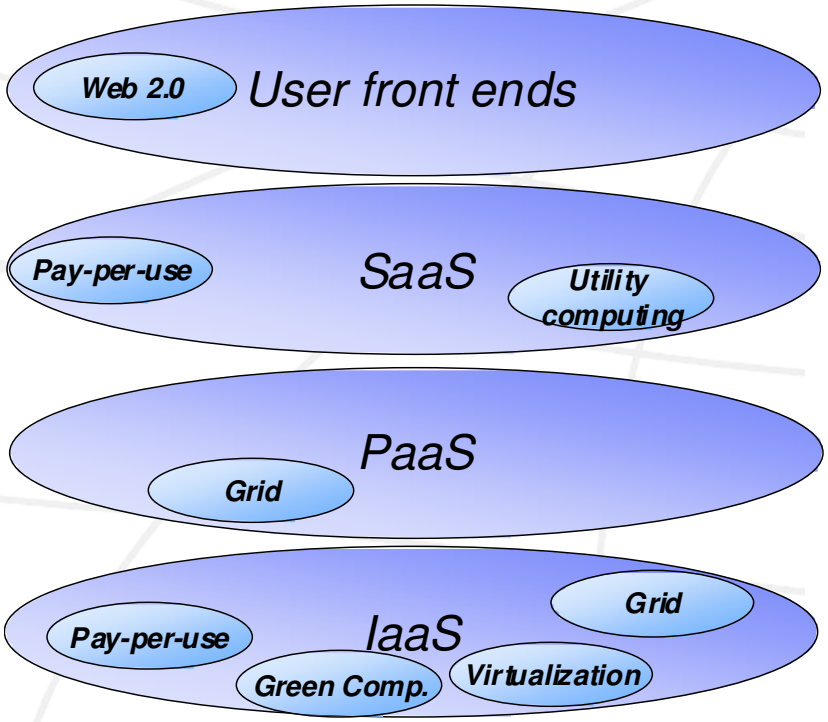
- By making no difference between academic Grids and commercial Clouds,
  g-Eclipse is the tools for **Groud** computing
  (Grid + Cloud = Groud)

- With the help of the 1919 Eclipse the theory of relativity was verified,
  g-Eclipse will help to prove …???

# Outlook – Grid in general

- How will Grids will look in the 64-Core-CPU time?
  - Service instead of Batch!
- The challenge will be the management on different levels in the XaaS world (XaaS = Everything as a Service)
- Cloud/Utility will be based on Virtualization with a lot of Grid behind the scene.

- 10000 foot view




→ The Heaven starts beyond the Cloud

Empowered by Innovation