The gLite Software Development Process

Alberto Di Meglio
EGEE – JRA1
CERN

gLite
Lightweight Middleware for Grid Computing

www.eu-egee.org

Information Society and Media

Overview

- Software configuration management
- QA tools and checkpoints
- QA Metrics and Process Auditing
- Beyond gLite

Software Process

- **JRA1 Software Process is based on an iterative method loosely based on RUP and some XP practices**
- **It comprises two main 12-month development cycles divided in shorter *development-integration-test-release* cycles lasting from 2 to 6 weeks**
- **The two main cycles starts with full Architecture and Design phases, but the architecture and design are periodically reviewed and verified.**
- **The process is fully documented in a number of standard document:**
  - Software Configuration Management Plan (SCM)
  - Test Plan
  - Quality Assurance Plan
  - Developer's Guide

SCM

- **The SCM Plan is the core document of the Software Process**
- **It contains a description of the processes and the procedures to be applied to the six SCM activity areas:**
  - Software configuration and versioning, tagging and branching conventions
  - Build Systems and Tools
  - Bug Tracking
  - Change Control and the Change Control Board (CCB)
  - Release Process
  - Process Auditing and QA Metrics
- **It is based on a number of standard methods and frameworks including:**
  - ISO 10007:2003 - Quality management systems -- Guidelines for configuration management, ISO, 2003
  - IEEE Software Engineering Guidelines (http://standards.ieee.org/reading/ieee/std/se)
  - The Rational Unified Process (http://www-306.ibm.com/software/awdtools/rup/)
- **In addition it adopts best-practice solutions[1] to guarantee the highest possible quality in a very distributed and heterogeneous collaboration**

[1]S.P. Berczuk, Software Configuration Management Patterns, Software Patterns Series, Addison-Wesley, 2002
A. Di Meglio et al., A Pattern-based Continuous Integration Framework for Distributed EGEE Grid Middleware Development, Proc. CHEP 2004

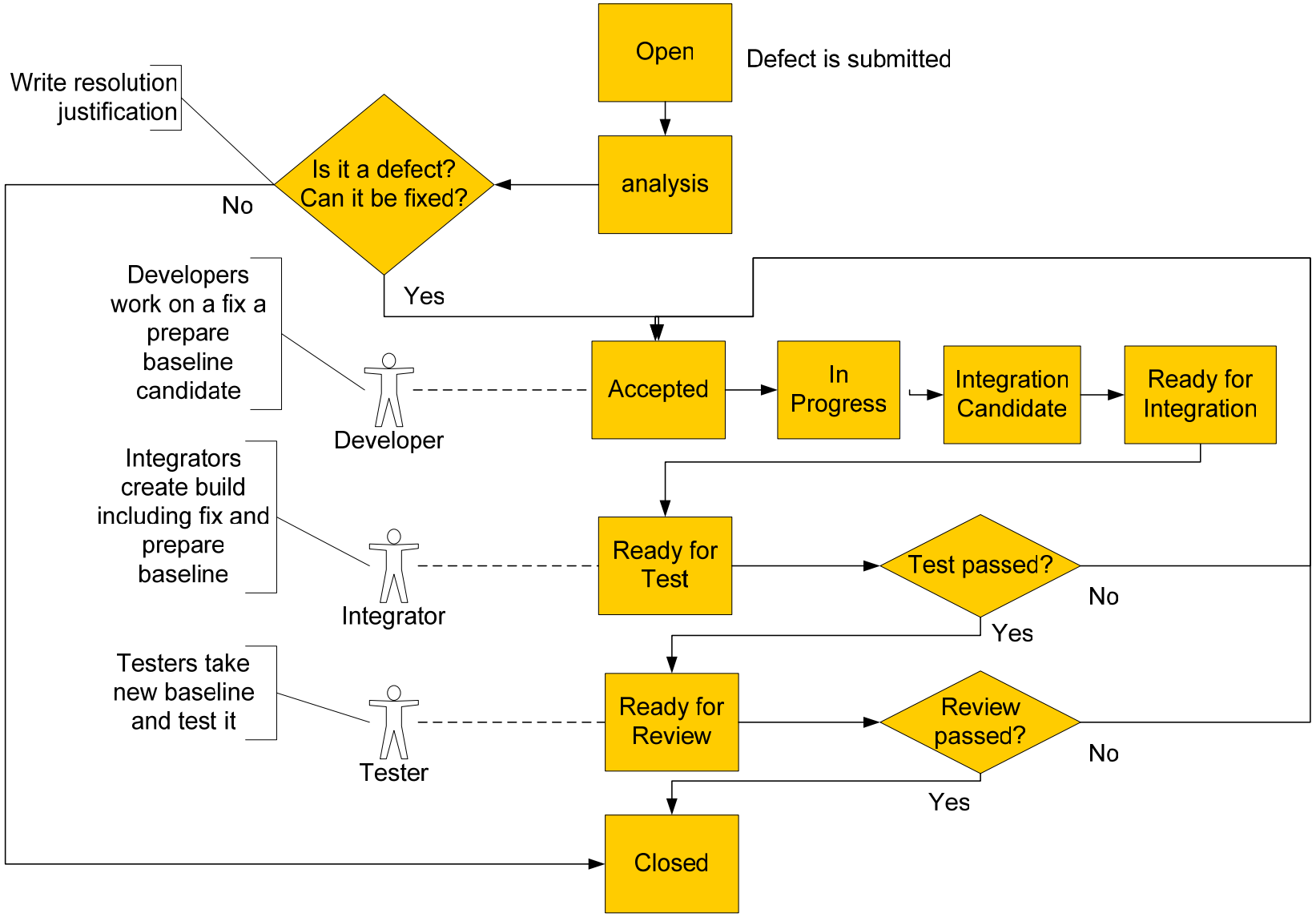
Build Infrastructure

- **Two nightly build servers on RH Linux 3.0 (ia32)**
  - Clean builds out of HEAD and v. 1.x every night of all components
  - Results are published to the gLite web site
  - Tagged every night and totally reproducible
- **One continuous build server on RH Linux 3.0 (ia32)**
  - Incremental builds out of v. 1.x every 60 minutes
  - Results published to CruiseControl web site
  - Automated build error notifications to developers and Integration Team
- **One nightly build server on RH Linux 3.0 (ia64)**
  - Clean builds every night of all components
- **One nightly build server on Windows XP**
  - Clean builds every night of all components currently ported to Windows
- **Build system supported platforms:**
  - Red Hat Linux 3.0 and binary compatible platforms (SLC 3, CentOS, etc), 32 and 64-bit (gcc)
  - Windows XP/2003 (at least for UI, but problems with third-party software like GT2.4)

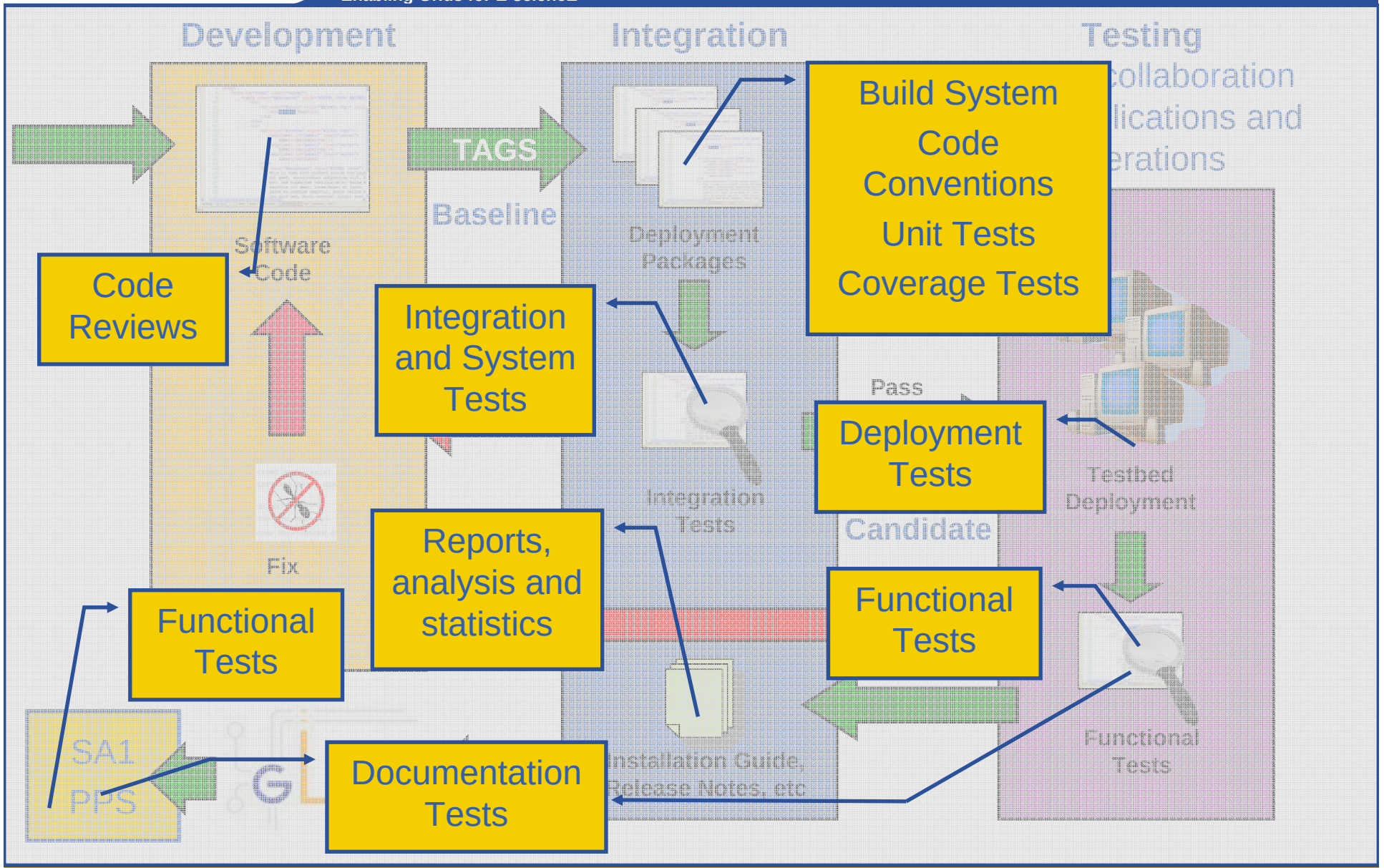
Defect Tracking System

- Based on the Savannah project portal at CERN
- Used also for change requests (for example API changes, external libraries version changes, etc). In this case, request are assigned to the Change Control Board for further evaluation
- Each gLite subsystem is tracked as a separate category and related bugs are assigned to the responsible clusters
- Third-party issues are also tracked here in addition to being reported to original provider

Defect Tracking Cycle



Release Process QA Checkpoints



Code Style and Conventions

gLite coding style report

system
org.glite

Summary			
Subsystems	**SLOC**	**Errors**	**Errors / line**
13	1091608	52792	0.0484

Subsystems			
Name	**Errors**	**Lines**	**Errors / line**
org.glite.jdl	2572	3847	0.6686
org.glite.ce	9575	26410	0.3626
org.glite.wms-ui	18785	93834	0.2002
org.glite.rgma	7677	110008	0.0698
org.glite.gpbox	6645	108168	0.0614
org.glite.service-discovery	336	7508	0.0448
org.glite.amga	1448	41802	0.0346
org.glite.security	3225	108056	0.0298
org.glite.wms	1888	297219	0.0064
org.glite.data	641	196888	0.0033
org.glite.dgas	0	31226	0.0000
org.glite.testsuites	0	63582	0.0000
org.glite.wms-utils	0	3060	0.0000

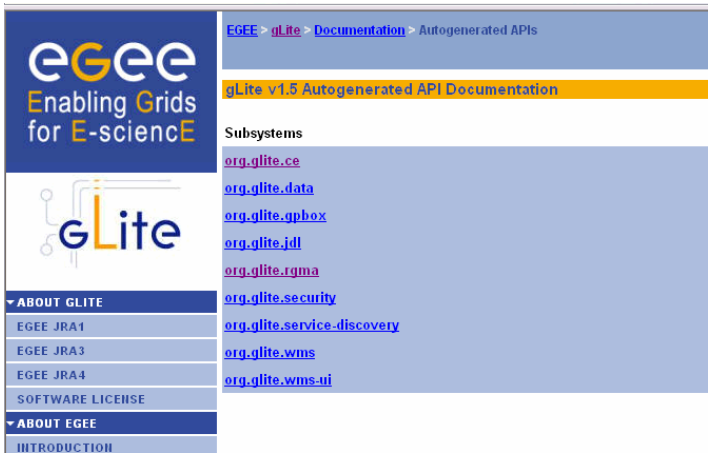
Coding conventions checked by CHECKSTYLE and CODEWIZARD
using the gLite coding conventions.
Line count by SLOCCOunt.

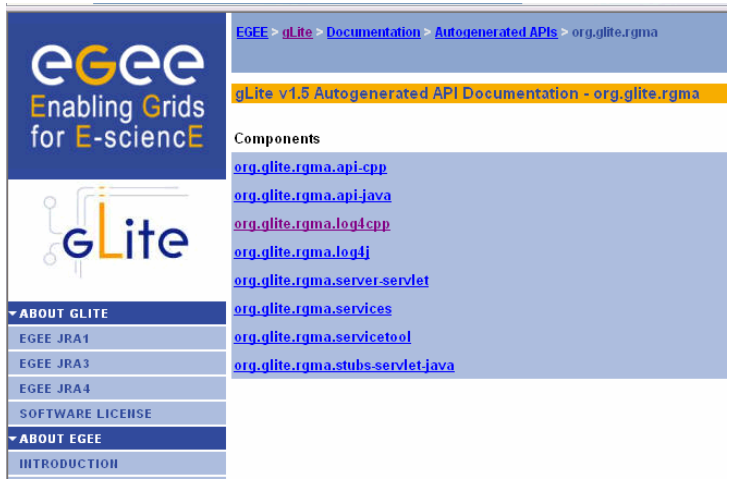
Unit Tests Reports

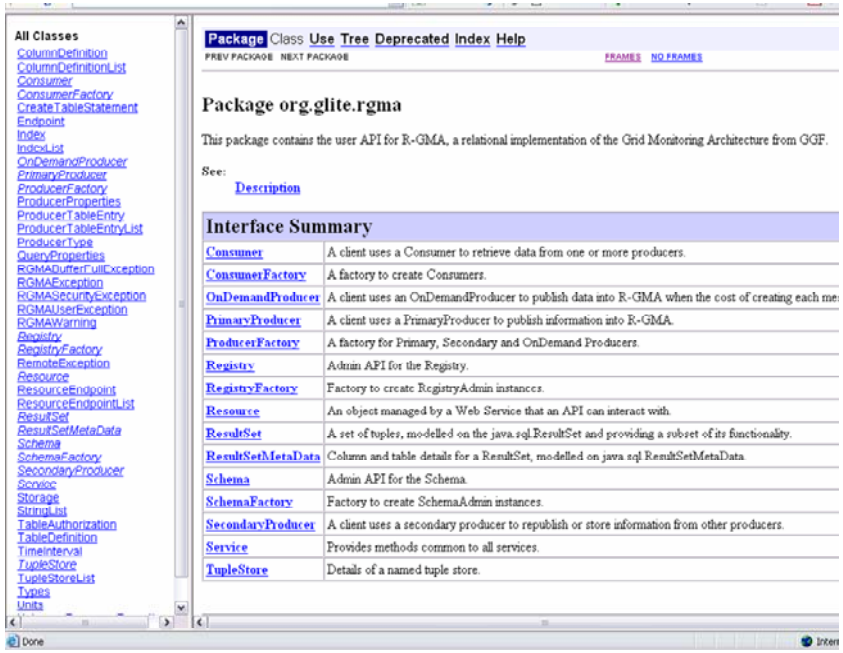
Build Results | Test Results | XML Log File | Control Panel

Name	Status	Time(s)
.org.glite.rgma.ProducerPropertiesTest		
testIsHistory	Success	0.008
testIsLatest	Success	0.000
Properties »		
.org.glite.rgma.QueryPropertiesTest		
testIsHistory	Success	0.008
testIsLatest	Success	0.000
testIsContinuous	Success	0.000
testEquals	Success	0.000
Properties »		
.org.glite.rgma.StorageTest		
testEquals	Success	0.006
testGetPassword	Success	0.000
testGetLocation	Success	0.000
testGetUserName	Success	0.000
testIsDatabase	Success	0.000
testIsMemory	Success	0.001
testHasDetails	Success	0.000
Properties »		
.org.glite.rgma.TimeIntervalTest		
testValueAsMillis	Success	0.006
testValueAsSeconds	Success	0.000
testValueAsMinutes	Success	0.000
testValueAsHours	Success	0.000
testValueAsDays	Success	0.000
Properties »		

Auto-generated Documentation







Regression Test Reports

Home

Packages

FiremanMysqlSecure
IOServerMysqlSecure

Classes

001 - mkdir_20050519_Tests44
002 - mkdir_20050519_Tests43
003 - rmdir_20050519_Tests44
004 - create_entry_20050519_Te
005 - ls_20050519
006 - 006 - put_lfn_800_chars_le
007 - file_close_tests
008 - file_creat_tests
009 - file_fstat_tests
010 - file_lseek_tests
011 - file_open_tests
012 - file_read_tests
013 - file_write_tests
014 - regression_test_for_bug_4
015 - regression_test_for_bug_4
016 - regression_test_for_bug_4
017 - regression_test_for_bug_5
018 - regression_test_for_bug_5
019 - 019 - 10_cycles_of_put_a_

gLite Functional and System Test Results

Designed for use with xUnit, xPyUnit, CPPUnit and ju

Package FiremanMysqlSecure

Classes

Name	Tests	Errors	Failures	Time(s)
001 - mkdir_20050519_Tests44	1	0	0	1.786
002 - mkdir_20050519_Tests43	1	0	0	1.744
003 - rmdir_20050519_Tests44	1	0	0	1.733
004 - create_entry_20050519_Tests43_zzTest	1	0	0	3.463
005 - ls_20050519	1	0	0	3.988
006 - 006 - put_lfn_800_chars_length	**1**	**1**	**0**	**3.500**

SLOC

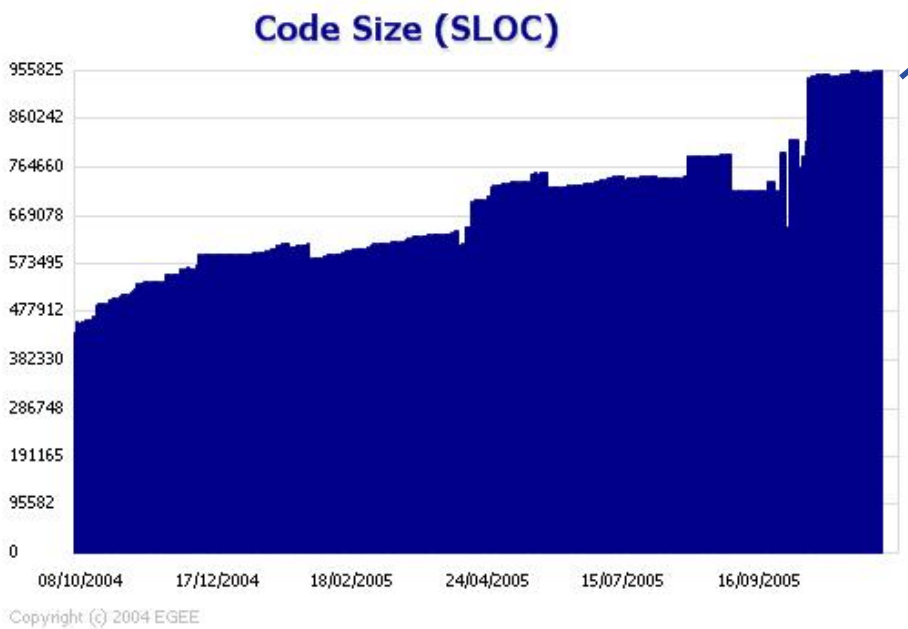
Total Physical Source Lines of Code (SLOC)

- SLOC = 955,825 (as of 21 November 2005)

Total SLOC by language (dominant language first)

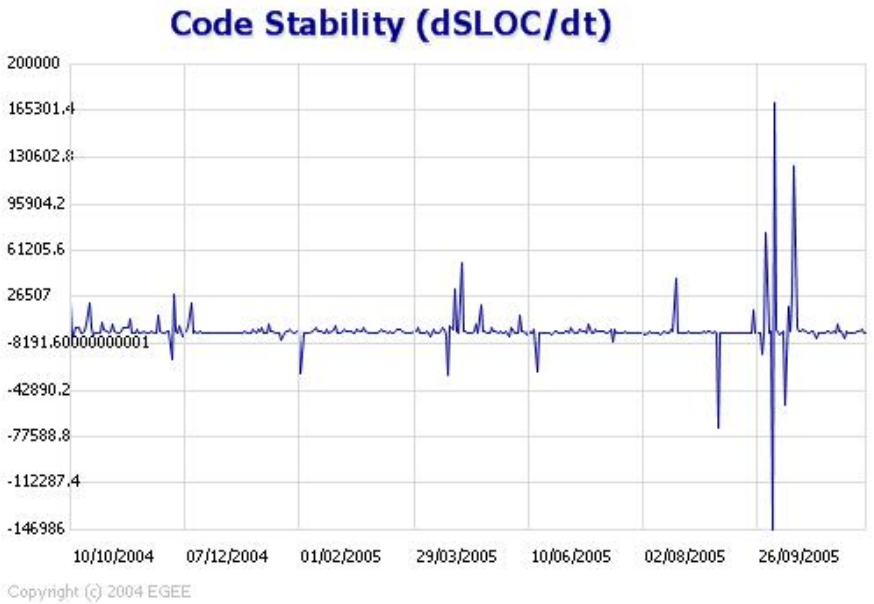
- Java 285271 (29.85%)
  C++ 266828 (27.92%)
  Ansi C 209326 (21.90%)
  Perl 75386 (7.89%)
  sh 70904 (7.42%)
  Python 43459 (4.55%)
- Total complete builds: 665 (all 1.x branches), 262 (HEAD)
- Number of subsystems: 18 (gLite 1.5) + 7 (queued)
- Number of CVS modules: 501
- Pre-Release Defects/KSLOC = 2.78
- Post-Release Defects/KSLOC = 1.14

Code Size and Stability



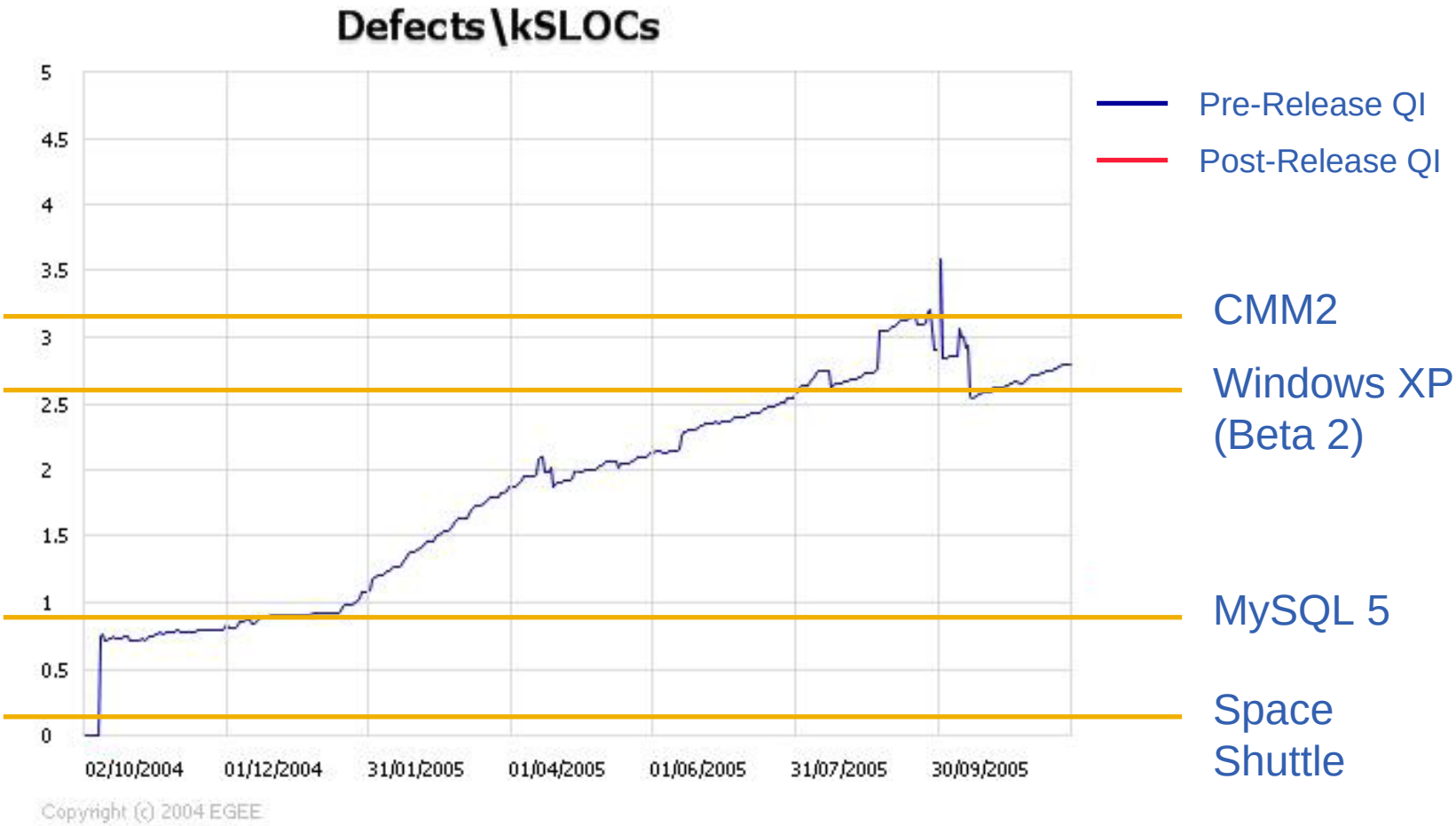
Jump is due to new code submitted for R1.5. Not all code will actually make it to the final release

The Code Size chart shows the changes in total number of SLOCs during the life of the project



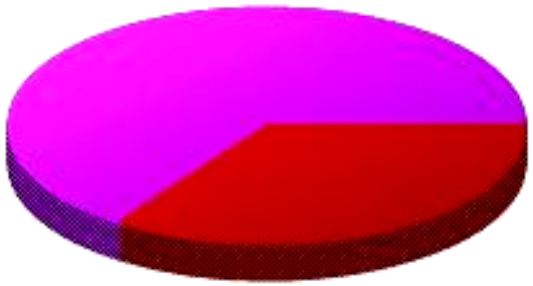
The Code Stability chart shows the change rate of code size during the life of the project.
As the project nears completion the rate should approach 0

The Defects/kSLOC Chart



Software Defects Statistics

Open and Closed Bugs



Open (1076 - 40.83%)
Closed (1559 - 59.17%)

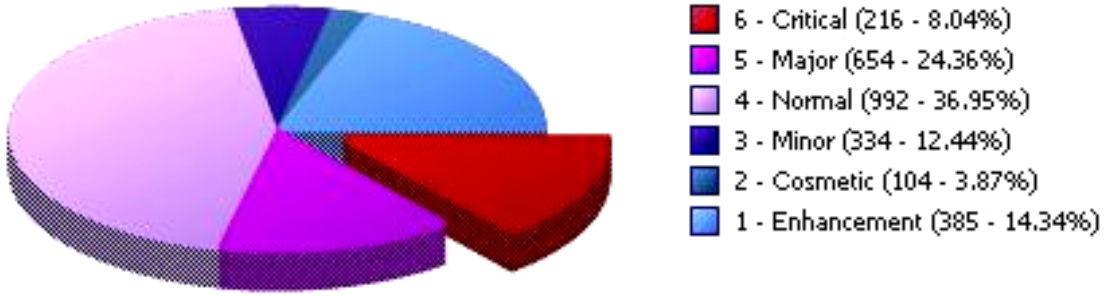
Adequate staffing of the Test Team is critical

Bugs Status

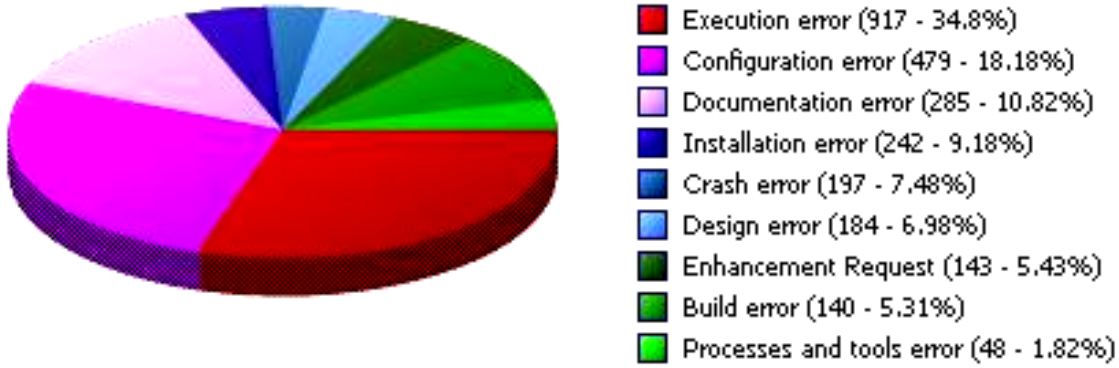
Ready for Test (358 - 13.59%)
None (193 - 7.32%)
Duplicate (159 - 6.03%)
Accepted (142 - 5.39%)
Ready for Integration (139 - 5.28%)
Remind (123 - 4.67%)
Wont Fix (67 - 2.54%)
In progress (60 - 2.28%)
Integration Candidate (50 - 1.9%)
Unreproducible (28 - 1.06%)
Ready for Review (10 - 0.38%)

Software Defects Statistics

Bugs Severity

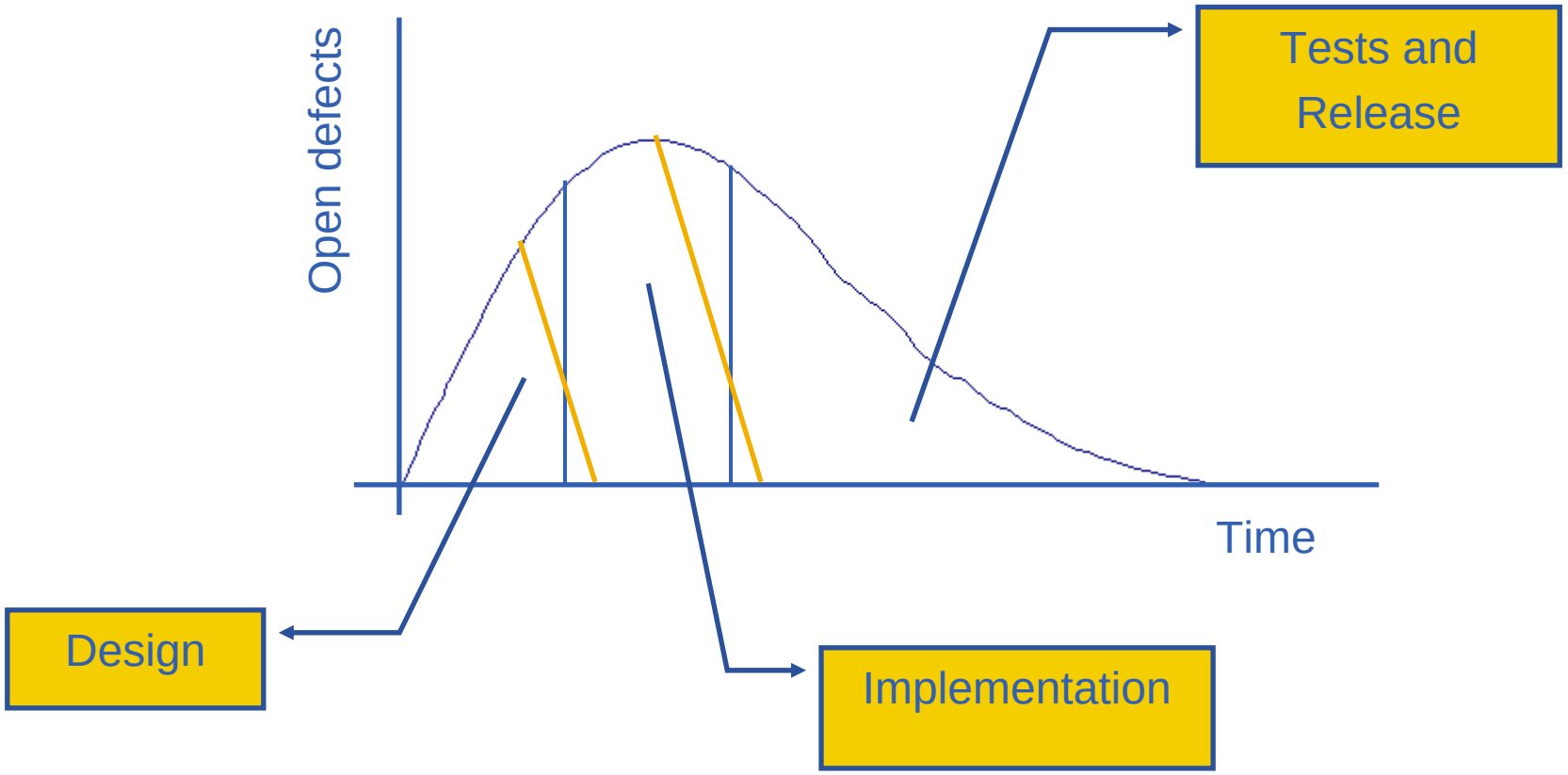


Bugs Type

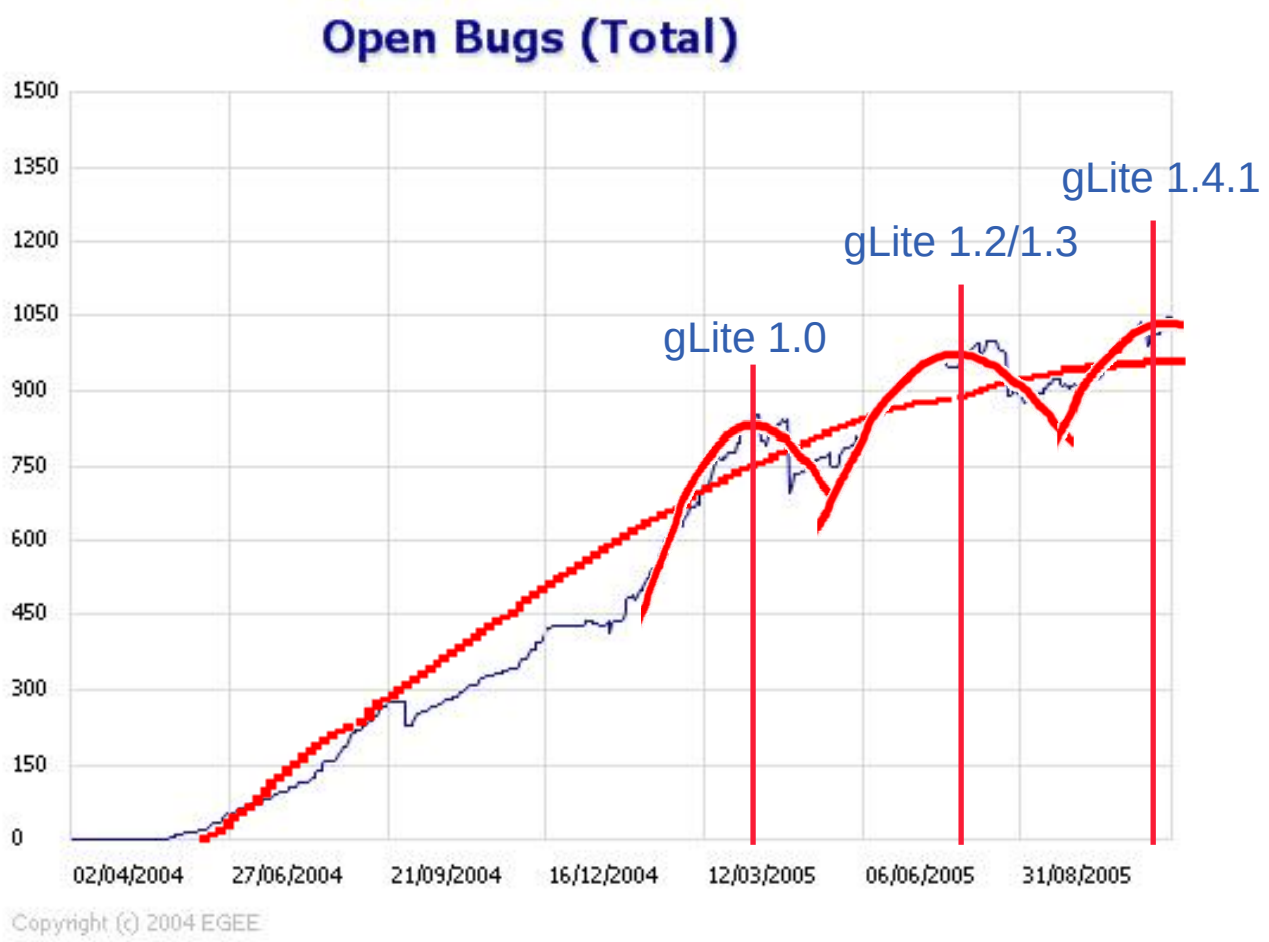


Defects Trends (I)

The Rayleigh Defect Prediction Model



Defects Trends (II)

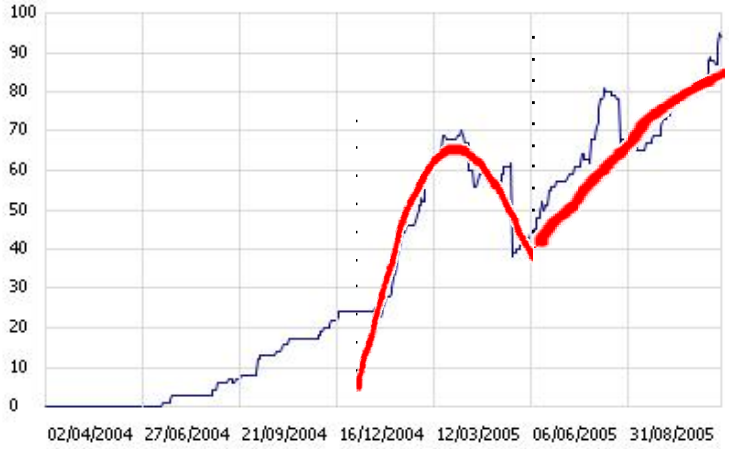


The Rayleigh Defect Prediction Model applied to gLite

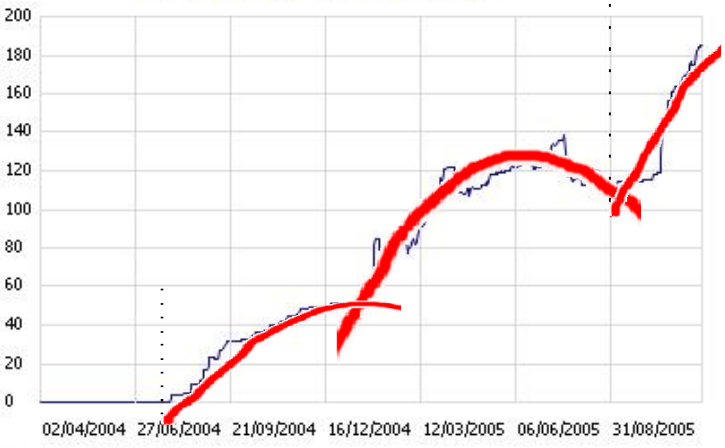
Defects Trends (III)

Open Bugs (Configuration)

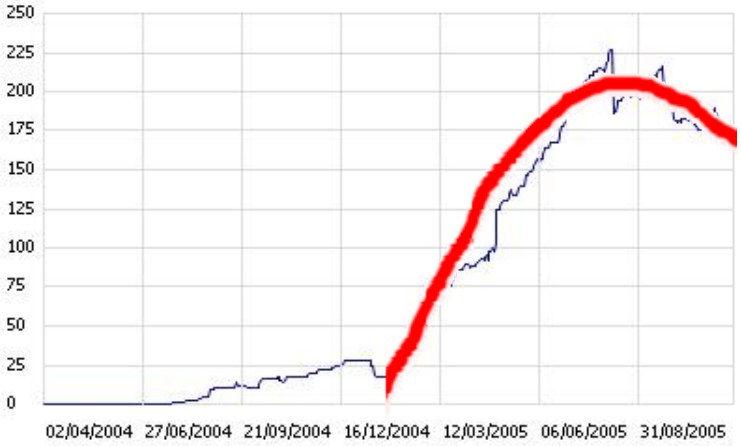
Open Bugs (WMS)



Open Bugs (R-GMA)



Open Bugs (Data Management)



Beyond gLite

- Collaborations in QA activities have been established with other projects
- External components are released through the gLite infrastructure (eg. Gridsite)
- Strong relationships exists with the NMI build and test infrastructure managed by the University of Wisconsin.
- Components from gLite are also distributed through VDT/NMI sharing the same release process (VOMS)
- A new project called ETICS is starting in January together with UoW and NMI to leverage the experience gathered during EGEE to provide distributed build and test services to other projects
- Collaborations in the QA field between EGEE/ETICS and other projects like Globus and OMII-EU are being established

Conclusions

- gLite is supported by a strong, industry-standard software engineering process
- Collection and analysis of QA metrics can provide a powerful tool for monitoring the status of the project and assessing critical areas of intervention
- The experience gathered during EGEE also in collaboration with other projects must be preserved and expanded
- Additional initiatives to strengthen the process and share the knowledge have been taken and are now moving well beyond the EGEE boundaries

More information

http://www.glite.org

http://cern.ch/egee-jra1