

EUROPEAN MIDDLEWARE INITIATIVE

SOFTWARE DEVELOPMENT QUALITY CONTROL REPORT

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Abstract:

This document describes the status and performance of the quality control task with details on the availability and execution of unit, functional and compliance tests for the EMI components. This report focuses on the quality control review activities for EMI 1 release.

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1. INTRODUCTION

1.1. PURPOSE

The main purpose of the periodic JRA1 Quality Control reports, as mandated by the Software Quality Assurance Plan [R 2], is to summarize the status and performance of quality control pertaining the EMI software development activities. In particular, the reports should sum up the results of the EMI software components reviews and provide details about the availability and execution of unit, functional and compliance tests for the EMI components. This report focuses on the status of the QC activity during the first year of the project and the EMI 1 release QC review.

1.2. DOCUMENT ORGANISATION

The rest of this document is organized as follows. Section 2 is the executive summary. Section 3 presents the QC activities in the first year of the project. Section 4 discusses the EMI 1 QC review. Results are summarized and recommendations on how to improve the current situation are given. Finally, Section 5 concludes the report.

1.3. REFERENCES

Table 1: Table of References

R 1	DJRA1.7.1 EMI Software Development Quality Control Report http://cdsweb.cern.ch/record/1277533/files/EMI%20Software%20Development%20Quality%20Control%20Report%20%28Q1%29.pdf
R 2	DSA2.1 EMI Software Quality Assurance Plan https://twiki.cern.ch/twiki/pub/EMI/DeliverableDSA21/EMI-DSA2.1-1277599-QA_Plan-v1.2.pdf
R 3	DSA2.3 – KPI and metrics definition document https://twiki.cern.ch/twiki/bin/view/EMI/EmiSa2MetricsGuidelines
R 4	DSA2.2.1 - QA Tools Documentation https://twiki.cern.ch/twiki/bin/edit/EMI/DeliverableDSA221
R 5	DSA2.4 – Continuous integration and certification testbeds https://twiki.cern.ch/twiki/bin/view/EMI/DeliverableDSA24
R 6	DSA2.3.1 – Periodic QA report https://twiki.cern.ch/twiki/bin/view/EMI/DeliverableDSA231
R 7	DJRA1.5 - Standardization Work Plan and Status Report https://twiki.cern.ch/twiki/bin/view/EMI/DeliverableDJRA151
R 8	DJRA1.6 – Integration Work Plan and Status Report https://twiki.cern.ch/twiki/bin/view/EMI/DeliverableDJRA161
R 9	DNA1.3.1 – Technical Development Plan https://twiki.cern.ch/twiki/bin/view/EMI/DeliverableDNA131
R 10	EMI Description of Work https://twiki.cern.ch/twiki/pub/EMI/EmiDocuments/EMI-Part_B_20100624-PUBLIC.pdf
R 11	EMI JRA1 Development and test plans https://twiki.cern.ch/twiki/bin/view/EMI/EmiJra1T1Coord
R 12	EGEE III SA3 Testing https://twiki.cern.ch/twiki/bin/view/EGEE/SA3Testing
R 13	EMI Test availability survey https://twiki.cern.ch/twiki/bin/view/EMI/EmiTestAvailabilitySurvey

R 14	S2 SRMv2 Compliance Test Suite http://s-2.sourceforge.net/
R 15	EMI 1 Production release Criteria https://twiki.cern.ch/twiki/bin/view/EMI/ProductionReleaseCriteria
R 16	EMI Release tracker https://savannah.cern.ch/task/?group=emi-releases
R 17	EMI SA 2 Release management policy https://twiki.cern.ch/twiki/bin/view/EMI/EmiSa2ReleaseManagementPolicy
R 18	EMI SA 2 Change management policy https://twiki.cern.ch/twiki/bin/view/EMI/EmiSa2ChangePolicy
R 19	EMI SA 2 Configuration and Integration policy https://twiki.cern.ch/twiki/bin/view/EMI/EmiSa2ConfigurationIntegrationPolicy
R 20	EMI SA 2 Packaging policy https://twiki.cern.ch/twiki/bin/view/EMI/EmiSa2PackagingPolicy
R 21	EMI SA 2 Testing policy https://twiki.cern.ch/twiki/bin/view/EMI/EmiSa2TestPolicy
R 22	EMI SA 2 Documentation policy https://twiki.cern.ch/twiki/bin/view/EMI/EMISa2DocumentationPolicy
R 23	EMI SA 2 Certification policy https://twiki.cern.ch/twiki/bin/view/EMI/EmiSa2CertPolicy
R 24	The Linux Filesystem Hierarchy Standard http://www.linuxfoundation.org/en/FHS
R 25	MSA1.2.1 EMI Referece Releases http://cdsweb.cern.ch/record/1277546/files/EMI_MS18_v1.0.pdf

1.4. DOCUMENT AMENDMENT PROCEDURE

Amendments, comments and suggestions should be sent to the author and/or to the emi-jra1-quality@eu-emi.eu mailing list.

This document can be amended by the authors further to any feedback from other teams or people. Minor changes, such as spelling corrections, content formatting or minor text re-organisation not affecting the content and meaning of the document can be applied by the authors without peer review. Other changes must be submitted to peer review and to the EMI PEB for approval.

When the document is modified for any reason, its version number shall be incremented accordingly. The document version number shall follow the standard EMI conventions for document versioning.

1.5. TERMINOLOGY

Table 2: Table of Acronyms

APEL	Accounting Processor for Event Logs component
-------------	---

ARC	Advanced Resource Connector
Argus	The Argus Authorization service
BDII	Berkeley Database Information Index
BES	Basic Execution Service
CREAM	The Computing Resource Execution and Management Cream Service
JSDL	Job Submission and Description Language
PT	Product Team
QA	Quality Assurance
QC	Quality Control
RfC	A Request for Change (RfC) is a formal request to change one or more software components.
SQAP	Software Quality Assurance Process
StoRM	Storage Resource Manager
VOMS	Virtual Organization Membership Service
VOMS Admin	Virtual Organization Membership Administration Service
WMS	Workload Management System

2. EXECUTIVE SUMMARY

This document is the second report on the status of the Quality Control (QC) activity in the context of the EMI JRA1 work package.

As stated in the EMI DoW[R 10], one of the JRA1 objectives is to “adopt standard software quality assurance and quality control procedures and perform them transparently to increase the confidence of the users in the software, but also the possibility of the middleware to be used or supported by commercial service providers and application developers”.

The Quality Control (QC) activity in JRA1 is part of the developers’ daily tasks whose objective is improving the developed software quality. This is achieved by ensuring compliance with selected code quality metrics, by enforcing that documentation respects the policy defined for the project and by increasingly testing the existing software, either in isolation or by checking the integration and interoperability with other EMI components.

QC is also responsible to monitor and assess the quality of middleware components developed by EMI product teams. In particular, QC has to ensure that all components developed by JRA1 satisfy certification and validation criteria established by SA2 [R 15,R 19,R 20,R 21,R 22,R 23] before they are handed over to SA1 for inclusion in EMI releases.

This report focuses on the description of the QC activities during the first year of the project. Much work have been done to adopt and implement the quality process defined by SA2, in particular by porting the building of the middleware to ETICS, repackaging the software according to SA2 policies, reorganize documentation as requested and and adopting the test and certification policies defined by SA2.

The components QC review for the EMI 1 release is also presented and its results summarized and analyzed. The initial results show that only 30% of the verified components were found to be fully compliant with the SA2 production release criteria[R 15]. Some recommendation on how to improve the situation are given.

3. STATUS OF THE JRA1 QUALITY CONTROL ACTIVITY

As introduced in the DJRA1.7.1 [R 1], JRA1 QC's main responsibility is to assess that PTs are following the SQAP process defined by SA2. Most of the EMI JRA1 work during the first year of the project was indeed focused on the implementation of the quality process defined by SA2, in particular

- porting the building of the software on the ETICS build system following the rules defined in the EMI configuration and integration policy [R 19]
- repackage software according to EMI packaging policy [R 20]
- test software components following the EMI testing policy [R 21]
- certify software components following the EMI certification policy [R 23]
- reorganize and harmonize documentation to be compliant with the EMI documentation policy [R 22]

All the above activities fall under the QC activity and are described briefly in the remainder of this section.

3.1. BUILDING AND INTEGRATION

Porting the building of software to ETICS was one of the biggest challenges in the first year of the EMI project. While many components were already successfully building on ETICS for the EMI-0 integration exercise release, as documented in the MSA1.2.1 [R 25] milestone document, the updated version of EMI configuration and integration policy and the introduction of the new dependency resolution mechanism in the 1.5 version of the ETICS client (released on February, 21st 2011) required significant changes in most components' ETICS configurations.

A full successful build for binary packages was first achieved on February, 14th on the EMI-1 release candidate 1 nightly build.

3.2. PACKAGING

Most components required radical changes in the way their packages were structured in order to comply with the EMI packaging policy [R 20]. In particular,

- Many packages had to be restructured in order to follow Fedora packaging guidelines and as such be compliant with the Filesystem Hierarchy Standard [R 24]
- Buildable source RPMs had to be produced for the supported platforms (Scientific Linux 5 X86_64 for EMI 1) besides tarballs and binary RPMs

The restructuring of the packages required significant changes in the configuration and startup code for many components. These changes were reflected in the documentation, which had to be adapted accordingly.

In the end, most components released in EMI 1 are compliant with FHS (the exceptions will be detailed later in this document) and 86% of the packages provide buildable source RPMs.

3.3. TESTING

EMI software components have been tested following the EMI SA2 Testing [R 21] policy. The following subsections describe the activities performance during the preparation of the EMI 1.

3.3.1 Test plan availability

Most PTs provided a test plan describing the test strategy used to assess their components' expected behavior. This is a significant improvement over the situation at the beginning of the project when most components missed a test plan.

3.3.2 Static code analysis and testing

The ETICS build system has been instrumented by SA2 with plugins to statically analyze the source code of the EMI components at build time. Currently plugins are only available for components developed in the Java programming language. No thresholds have been defined for code quality metrics. These tools were typically ignored by PTs during the preparation of the EMI 1 release to assess the quality of their code, so no improvement is measured over the situation at the beginning of the project.

3.3.3 Unit tests

Unit tests are mandatory for all the EMI software components, but no code coverage threshold has been set by SA2. The main reason for this is that it is not clear how to write a plugin for the ETICS build system to correctly compute the coverage for code developed in several programming languages.

It is also unclear what does “mandatory” mean for PTs. Some middleware components (e.g., UNICORE) were developed with a comprehensive unit test suite that shows good coverage, while others (e.g., most gLite and ARC PTs) pursued other strategies (mainly functional test suites) to check the component's functionality. Should unit tests be developed for all EMI components so that a minimum coverage threshold is reached for all the code? Should only new functionality whose developed is funded by EMI be properly unit tested? How can this be verified by QC? No clear recommendation has been given yet on this subject from SA2.

For the above reasons no significant improvement is measured over the situation at the beginning of the project as presented in DJRA1.7.1 [R 1].

3.3.4 Regression tests

Regression tests make sure that bugs fixed in the past are not reintroduced in the future when the code is changed. The status of regression testing for EMI components is monitored by SA1 QC activity and will not be covered in this report.

3.3.5 Deployment tests

Most PTs included deployment and configuration reports in their testing reports for EMI 1 as requested testing policy. Deployment and configuration test results are required to prove that components can be installed and configured properly on EMI supported platforms.

3.3.6 Certification

Significant effort have been put in the certification of EMI components as the final step for PTs in the EMI 1 release preparation. Certification is defined in the EMI Certification policy as “the action done by a PT on a component release in order to certify that the PT has followed and applied the SA2 policies during the component release development, documentation and testing phases” [R 23].

The only components that were not included in the EMI 1 release were excluded due to problems related with the certification was not considered appropriate for the

3.4. SOFTWARE DOCUMENTATION

The documentation has been reorganized following the rules of the EMI documentation policy [R 22] by most PTs. Some PTs did not convert the documentation to PDF as requested by the policy but provided all the requested information in other formats (e.g., wiki pages).

The status of the documentation is reviewed in SA2 periodic QA reports and will not be discussed here.

3.5. SOFTWARE COMPONENTS REVIEW

3.5.1 SA2 Production Release Criteria

SA2 Production Release criteria [R 15] define the minimum set of criteria considered to be mandatory in a component release scheduled for production. These criteria are verified by QC before a

component can be released in production. The output of the verification is a report informing about the compliance with the criteria. The criteria to be verified have been organized by SA2 as follows:

Category	Checked Criteria
Change management	<p>Every component release must be tracked in a component release task created by the release manager in the EMI release tracker [R 16].</p> <p>All the changes included in the component release must be tracked in an RfC in the PT tracking tool. All the RfCs must be attached to the component release task.</p>
Integration and configuration	<p>Every component release must have a corresponding ETICS component (and subsystem) configuration in ETICS.</p> <p>The component configuration must contain a tag of the code.</p> <p>The configuration must build without errors in the nightly build of the release candidate project configuration.</p>
Packaging	<p>Every component release must include a link to all the new packages in all supported packaging formats.</p>
Testing	<p>Every component release task must include a link to the test plan of the component.</p> <p>The minimum set of tests that are mandatory at this stage of the project are: Unit tests, Deployment tests, Basic functionality tests, Any existing automatic regression test.</p> <p>Every component release task must attach the test report for the component including the test results of the mentioned set of tests.</p>
Documentation	<p>The following documents must be provided by PTs: Release notes, Functional description, User guide, Client installation and configuration guide, System administrator guide, Service reference card.</p>
Certification	<p>Every component release must include a link to the certification report.</p>

Tabella 3: Production release criteria

The above criteria have been checked for all EMI 1 components. The results of the review are presented in the next section.

4. EMI 1 QUALITY CONTROL REVIEW

The EMI 1 Kebnekaise release was officially released to the public on May, 12th 2011. All the components included in the release have been verified by the QC team.

The QC review was coordinated by Giuseppe Fiameni and shared among five persons (Maria Alandes Pradillo, Claudio Cacciari, Andrea Ceccanti, Jozef Cernak and Giuseppe Fiameni) in order to speed up the verification process as much as possible. An online verification form (see Figure 1) was created by Giuseppe Fiameni leveraging Google Documents. The advantage of this approach is that all the verification report would be kept at a single shared online spreadsheet. Verification reports were periodically generated from the spreadsheet data using an AWK script and attached to the tasks in the release tracker.

EMI 1 Quality Control Verification

<https://twiki.cern.ch/twiki/bin/view/EMI/SA1CVEMI1>

* Required

EMI QC Report

Component Name *

Savannah Task ID *

19732

EMI Major Release *

EMI 1

EMI 1

Platform *

SL5

SL5

Author *

Andrea Ceccanti

Date of the verification *

MM/DD/YYYY

Summary

List or RFCs *

Are RFCs available?

Yes

No

ETICS configuration and VCS TAG *

Yes

No

Figure 1: A screenshot of the online verification form used to gather QC verification information.

The QC review, for each component, was triggered by the corresponding task in the EMI release tracker [R 16] being moved to the “Certified” state by PTs. The review was split in two parts:

1. Documentation review, coordinated by Maria Alandes Pradillo, and documented in SA2 QA periodic reports. This review checks, for each component, that the documentation is appropriate and up-to-date.
2. QC review: this review focuses on checking that all the other production release criteria are met.

4.1. RESULTS

57 unique components were verified (some of them were verified multiple times) in the period from April, 15th 2011 to May, 10th 2011.

Of all the components verified, only 32% were found to be fully compliant with the EMI 1 production release criteria, as shown in Figure 2.

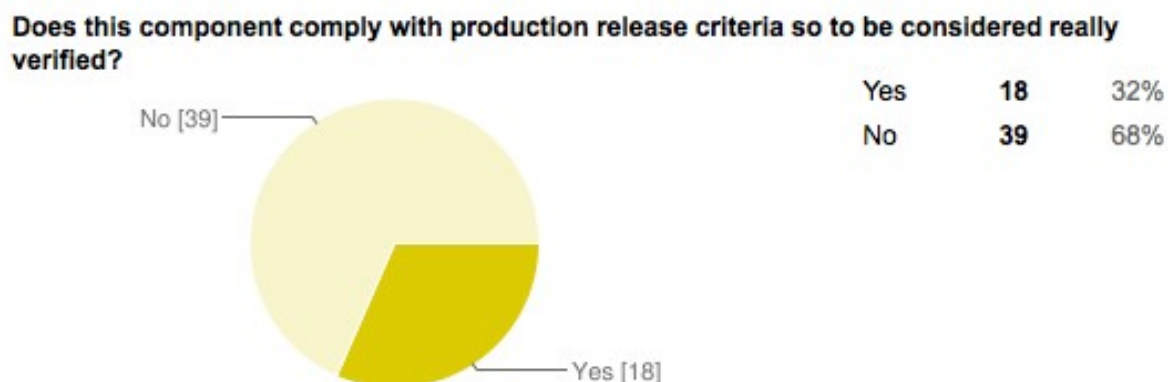


Figure 2: Only 32% of the packages in the end correctly listed all the packages in their task as requested.

4.1.1 Fully Compliant components

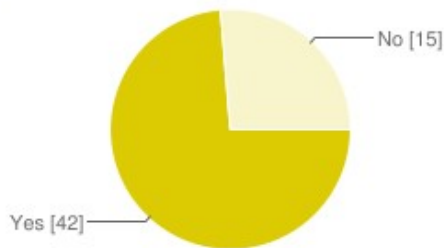
The following table gives the components that were verified to be fully compliant with SA 2 policies:

Task #	Component name
20404	CREAM LSF module
20403	CREAM TORQUE module
20412	gLite CLUSTER
18713	gLite gsoap/gss v. 3.0.2
19732	EMI WN
20401	TORQUE server config
20402	TORQUE WN config
18704	Trustmanager
18733	UNICORE AIP v.2.0.0
18729	UNICORE Gateway
18581	UNICORE HILA
19488	UNICORE Registry v.6.4.0
18574	UNICORE TSI v.6.4.0
18732	UNICORE XACML PDP v.2.0.0
18730	UNICORE XUADB v.1.3.2
18731	UVOS v.1.4.1
18587	VOMS v.2.0.0
18568	WMS v.3.3.0

Tabella 4: Components verified to be fully compliant with SA2 policies

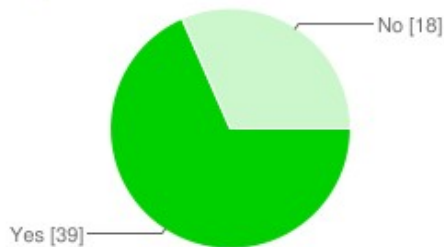
4.1.2 Basic task integrity checks

List or RfCs



Yes	42	74%
No	15	26%

ETICS configuration and VCS TAG



Yes	39	68%
No	18	32%

Figure 3: Basic task integrity checks results.

RfCs and ETICS configuration and VCS tag were correctly listed in the task for the majority of components (74% and 67% respectively).

Components that did not introduce new functionality or bug fixes were not required to list any RfCs in their task. Besides these components, failures are caused by PTs non listing RfCs at all or failing to do so in the requested way (BDII, GFAL, glite-proxyrenewal).

Some components failed in including the VCS tag for their certification report while others forgot to lock the configuration before moving their task to the “Certified” state.

4.1.3 Certification report availability and completeness checks

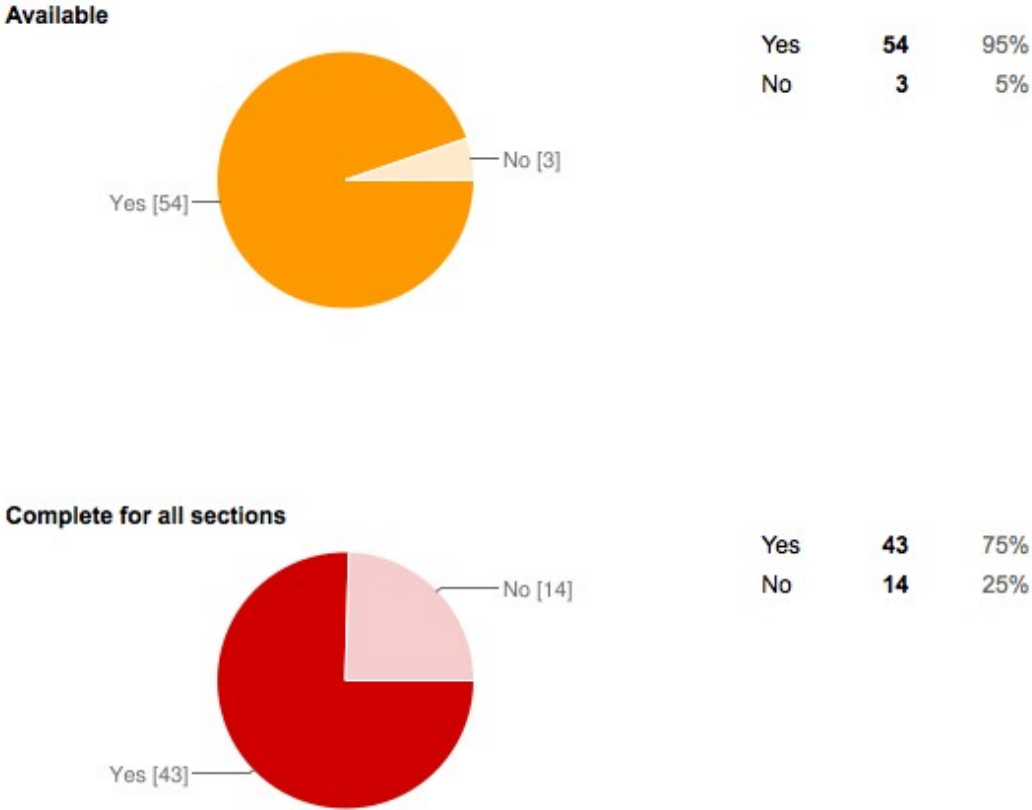


Figure 4: Certification report availability and completeness checks

The pie charts above summarize the results of the certification report availability and completeness checks. All PTs correctly attached a certification report to their task, with the exception of the core, top and site BDII components. The certification report was complete in all sections for 75% of the verified components.

4.1.4 Test reports checks

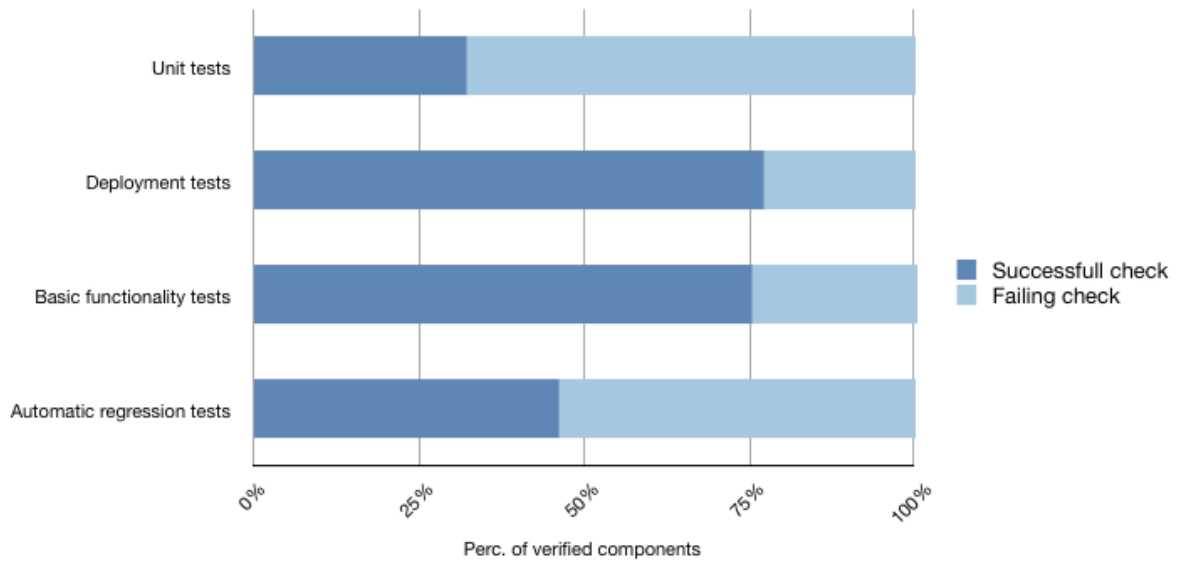


Figure 5: Test availability checks results. The check verified that results of the tests were correctly included in the test report for the verified components.

The chart in Figure 5 summarizes the results of test availability checks. Most components correctly reported about deployment and basic functionality tests. Regression tests were present only in half of the reports while unit tests only in one third the verified components. Some failures were caused by missing test reports (ARGUS-EES, BDII, glite-yaim-core) or test reports not compliant with the required format (DPM, GFAL/lcg_util, LFC, gLexec, lcas, lcmaps).

Only 20% of the components proved to report correctly for all the types of tests, i.e.: ARC InfoSys, Argus, dCache, gLite-MPI, Trustmanager, UNICORE clients, UNICORE Gateway, UNICORE HILA, UNICORE Registry, UNICORE WS, UNICORE XUUDB, VOMS.

4.1.5 Package availability checks

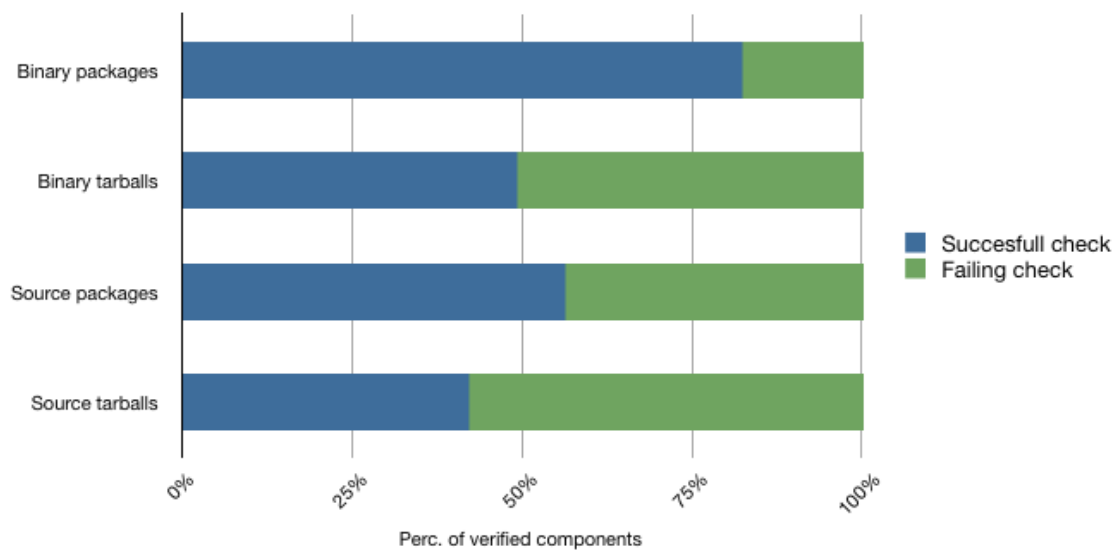


Figure 6: Package availability check. The check verified that packages were correctly listed in the component tracker task and available in the release candidate repository

QC verified that packages were correctly listed in the component tracker task and available in the EMI release candidate repository. The chart above summarizes the results of these checks.

Most components (82%) correctly listed the binary packages in their task on the tracker, while less than half of the components (on average) succeeded in listing correctly binary tarballs and source packages. Only 30% of the components correctly listed all the packages in their task as requested. Among the failing components, notable exceptions are some UNICORE libraries that do not build their packages in ETICS and are installed as part of other UNICORE components. The UNICORE libraries are: UNICORE AIP, UNICORE security libraries, UNICORE services environment, UNICORE XACML PDP and UNICORE XNJS.

In the future is recommended that these components are not tracked in the release tracker.

4.2. RECOMMENDATIONS

The results of the review are not really promising and show that much work needs to be done in order to improve EMI software quality. Here is a list of general recommendations to SA2 aimed at improving the current situation:

- Improve PT awareness of the quality process. SA2 Policies are felt as useless bureaucracy from many PTs who fail to see the advantage in having a clearly defined quality process.
- Components failing to be compliant with expected quality criteria should not be included in EMI releases. This will foster PTs to be compliant with the policies.
- Define clear target thresholds for key code quality metrics to be achieved for the EMI 2 and EMI 3 release.
- Provide tools to QC to monitor the evolution of quality metrics: in particular, as mentioned in the SQAP [R 2], a dashboard should be provided that “will automatically collect and publish the relevant metrics and measurements associated to the software components” so that alarms and notification on deviations can be monitored by QC.
- Improve build and integration tools stability and documentation.

5. CONCLUSIONS

This report presented the JRA1 QC activities during the first year of the project. Much work have been done to adopt and implement the quality process defined by SA2, in particular by porting the building of the middleware to ETICS, repackaging the software according to SA2 policies, reorganize documentation as requested and and adopting the test and certification policies defined by SA2.

The implementation of the quality process is however not optimal at this point in time. The components QC review for the EMI 1 release results show that only 30% of the verified components were found to be fully compliant with the SA2 production release criteria[R 15]. The main motivation for this is that Quality is not perceived by PTs as a crucial aspect of their development work and the policies defined by SA2 are often considered useless bureaucracy.

To improve the situation, better communication between SA2 and JRA1 is recommended in order to increase awareness in PTs of the quality process.

It is also crucial that clear target thresholds are defined for quality metrics important for the next EMI release. Such quality target should be communicated to PTs as soon as possible, so that the development plans can take the effort to be compliant with the metrics into account.

Finally, better tools must be provided to monitor the evolution of quality aspects in the developed software components. To clear objective should be to make QC review work more timely and effective in order to provide prompter feedback and support to PTs in the implementation of the quality process defined by SA2.