



Delivering Excellence in Software Engineering

SEC(R) 2005



Continuous Integration – a way to successful Delivery

Agenda

- About EPAM Systems
- Continuous Integration: The Theory
- Accountable Project Front-End as The Project Health Monitor
- How It Works in Reality
- Automated Delivery Made Possible
- EPAM Build Engineering Team
- Continuous Integration: Conclusions



About EPAM Systems

EPAM at a Glance

- US Corporation founded in Princeton, 1993
- No.1 on "Top 5 to Watch in Central and Eastern Europe" ("Offshore 100", 2005)
- No.3 on global "Top 10 Specialty Application Development Leaders" ("Offshore 100", 2005)
- Over 1300 software engineers
- Geo-diverse delivery: US, Russia, Hungary, Belarus
- First CMMI Level 4 assessment in Europe
- Successful projects deployed in over 30 countries
- 6,5+ million hours of software development experience

<http://www.epam.com>

EPAM Selected Clients

Global business leaders such as Reuters, CareFirst BCBS, Empire BCBS, Colgate-Palmolive, Halliburton, London Stock Exchange, SBLI, British Telecom, AeroMexico, Schlumberger.

Global technology leaders such as SAP, Microsoft, BEA Systems, Hyperion, Sun Microsystems.



Leveraging a global advantage

By Jon Udell, April 18, 2003

"EPAM equips teams with the best tools, trains them to use and refine best practices in multiple disciplines, and deploy them in engagements that are, for their clients, highly strategic..."



Continuous Integration: The Theory

The Challenge: a distributed team working on a large software product around the clock in multiple development streams.

The Solution: Continuous Integration as a fully-automated build and testing process which allows a development team to constantly build and test their software artifacts.

Terms & Conditions:

- Gold source code repository
- Frequent check-in
- Automated build scripts
- Automated tests
- Dedicated build environment
- Master build
- The More Often the Better



Accountable Project Front-End as The Project Health Monitor

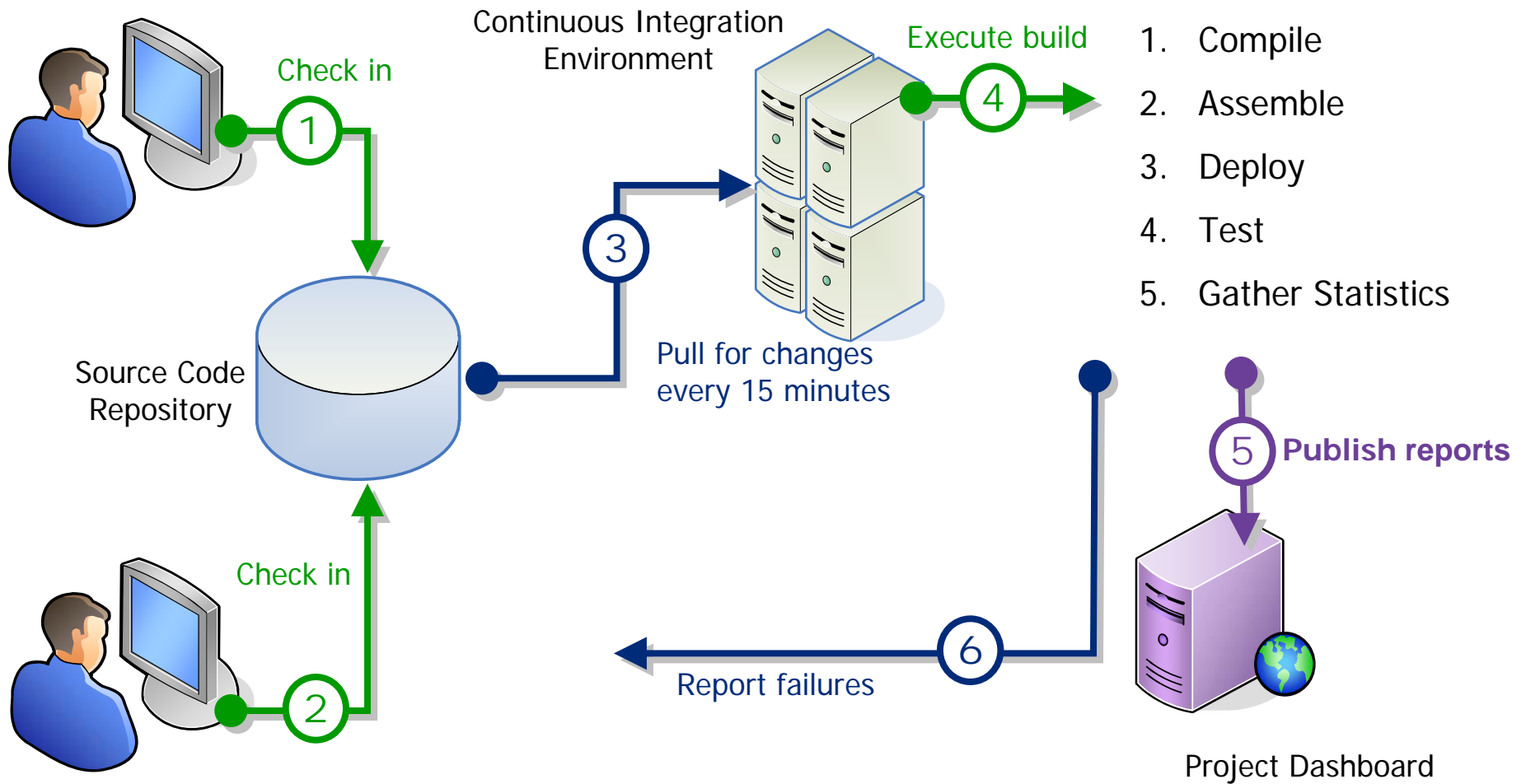
The questions you cannot ignore:

- How well is your software covered with Unit Tests ?
- How many tests failed during the last build?
- Which tests failed during the last build?
- How good is your source code?
- Is your source code documented clearly and correctly?

Continuous Integration process allows you to gather any desired statistics about your software artifacts and keep it up-to-date. Automatically.



How It Works in Reality: The Process



Available Tools:

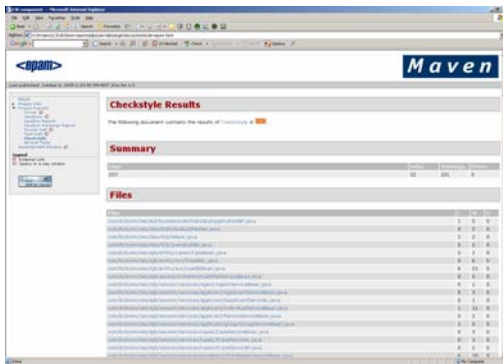
Java Platform: Ant, Cruise Control, JUnit, Apache Maven, CheckStyle, PMD, JCoverage, Clover

.NET Platform: NAnt, Cruise Control.NET, NUnit, FxCop, nCover, msbuild

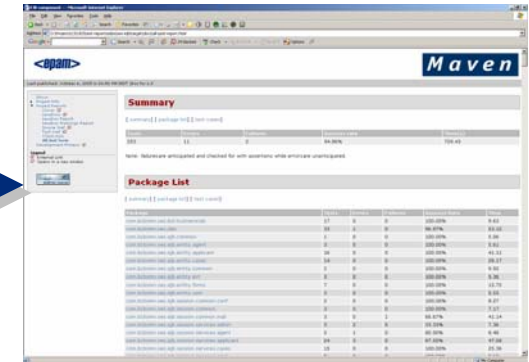


How It Works in Reality: The Health Monitor

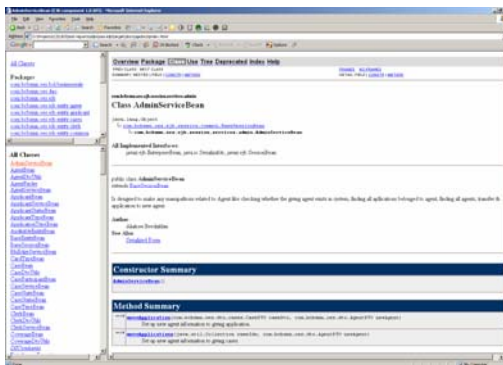
Code Quality Report



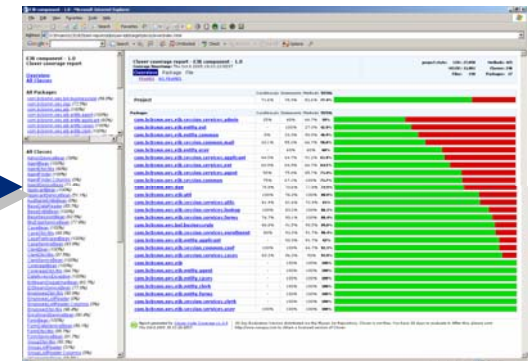
Unit Tests Results



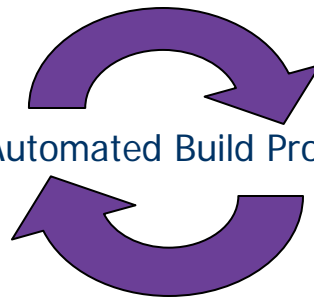
Code Documentation Reports



Test Coverage Report



Automated Build Process



Health Monitor: Code Quality Report


Summary

Files	Infos	Warnings	Errors
23	1	17	0


Files

Files	I	W	E
com/bcbsmn/oes/bol/common/AbstractServiceImpl.java	1	0	0
com/bcbsmn/oes/bol/facades/ext/impl/MailServiceImpl.java	0	6	0
com/bcbsmn/oes/bol/facades/impl/ApplicantServiceImpl.java	0	3	0
com/bcbsmn/oes/bol/facades/impl/EnrollmentServiceImpl.java	0	3	0
com/bcbsmn/oes/bol/facades/impl/IndividualServiceImpl.java	0	5	0

[com/bcbsmn/oes/bol/common/AbstractServiceImpl.java](#)




Error	Line
 Variable 'useRemoteCall' must be private and have accessor methods.	31

[com/bcbsmn/oes/bol/facades/ext/impl/MailServiceImpl.java](#)

Error	Line
 Line is longer than 80 characters.	67
 Line is longer than 80 characters.	68
 Line is longer than 80 characters.	78
 Line is longer than 80 characters.	79
 Line is longer than 80 characters.	80
 Line is longer than 80 characters.	120



Health Monitor: Code Quality Details

Error	Line
 More than 7 parameters.	97
 Each variable declaration must be in its own statement.	265
 Variable 'size' should be declared final.	265

```
97 public static boolean appendCondition(final String value,  
98                                     final String fieldName,  
99                                     final String alias,  
100                                    final boolean isFirstCondition,  
101                                    final StringBuffer query,  
102                                    final List parameters,  
103                                    final boolean ignoreCase,  
104                                    final boolean enableLike)  
105 {  
106     final boolean conditionPresent;
```



Health Monitor: Unit Test Results

Summary

[\[summary \]](#) [\[package list \]](#) [\[test cases \]](#)

Tests	Errors	Failures	Success rate	Time(s)
255	1	0	99.61%	1009.44

Note: *failures* are anticipated and checked for with assertions while *errors* are unanticipated.


Package List

[\[summary \]](#) [\[package list \]](#) [\[test cases \]](#)






Package	Tests	Errors	Failures	Success Rate	Time
com.bcbsmn.oes.bol.businessrule	17	0	0	100.00%	17.36
com.bcbsmn.oes.dao	33	0	0	100.00%	109.04
com.bcbsmn.oes.ejb.common	1	0	0	100.00%	4.06
com.bcbsmn.oes.ejb.entity.agent	3	0	0	100.00%	4.48
com.bcbsmn.oes.ejb.entity.applicant	16	0	0	100.00%	34.42
com.bcbsmn.oes.ejb.entity.cases	14	0	0	100.00%	22.20
com.bcbsmn.oes.ejb.entity.common	2	0	0	100.00%	8.13
com.bcbsmn.oes.ejb.entity.ext	5	0	0	100.00%	12.64
com.bcbsmn.oes.ejb.entity.forms	7	0	0	100.00%	13.16



Unit Test Results: Details

Class	Tests	Errors	Failures	Success Rate	Time
 MailGeneralBuilderTest	5	1	0	80.00%	10.173

MailGeneralBuilderTest

	testBuildCasesCreated	6.28
	testBuildCasesUpdated	0.97
	testBuildPlansChanged	0.83
	testBuildPlansRemoved	0.77
	testPrepareBusinessMail	0.89

Failure details

testBuildPlansRemoved

N/A

```
java.lang.NullPointerException at
com.bcbsmn.oes.ejb.session.services.utils.MailGeneralBuilder.buildPlansRemoved(M
ailGeneralBuilder.java:468) at
com.bcbsmn.oes.ejb.session.services.utils.MailGeneralBuilderTest.testBuildPlansR
emoved(MailGeneralBuilderTest.java:260)
```



Health Monitor: Test Coverage Report

Clover coverage report - EJB component - 1.0

Coverage timestamp: Thu Oct 6 2005 18:31:23 EEST

[Overview](#) Package File

[FRAMES](#) [NO FRAMES](#)

project stats:	LOC: 27,050	Methods: 425
	NCLOC: 11,861	Classes: 246
	Files: 238	Packages: 27

Project	Conditionals	Statements	Methods	TOTAL	
	71.6%	78.3%	82.6%	77.4%	
Packages	Conditionals	Statements	Methods	TOTAL	
com.bcbsmn.oes.ejb.entity.common	0%	33.3%	90.9%	46.9%	
com.bcbsmn.oes.ejb.session.common.mail	32.1%	55.2%	66.7%	50.8%	
com.bcbsmn.oes.ejb.entity.user	-	60%	60%	60%	
com.bcbsmn.oes.ejb.session.services.applicant	44.3%	64.7%	91.2%	61.9%	
com.bcbsmn.oes.ejb.session.services.ext	60.9%	64.9%	66.7%	64.5%	
com.bcbsmn.oes.ejb.session.services.agent	50%	75.4%	85.7%	71.4%	
com.bcbsmn.oes.ejb.session.common	75%	67.1%	100%	71.7%	
com.bcbsmn.oes.dao	75.8%	70.6%	77.8%	72.5%	
com.bcbsmn.oes.ejb.util	100%	76.3%	100%	80.9%	
com.bcbsmn.oes.ejb.session.services.utils	81.9%	81.6%	72.9%	81%	
com.bcbsmn.oes.ejb.session.services.lookup	100%	83.2%	100%	86.1%	
com.bcbsmn.oes.ejb.session.services.forms	76.7%	90.1%	100%	88.4%	
com.bcbsmn.oes.bol.businessrule	86.8%	91.5%	90.5%	89.8%	
com.bcbsmn.oes.ejb.session.services.enrollment	80%	93.3%	91.7%	90.4%	
com.bcbsmn.oes.ejb.entity.applicant	-	92.3%	91.7%	92%	
com.bcbsmn.oes.ejb.session.common.conf	100%	100%	66.7%	92.3%	
com.bcbsmn.oes.ejb.session.services.cases	83.3%	96.3%	90%	93.9%	
com.bcbsmn.oes.ejb	-	100%	100%	100%	
com.bcbsmn.oes.ejb.entity.agent	-	100%	100%	100%	
com.bcbsmn.oes.ejb.entity.cases	-	100%	100%	100%	
com.bcbsmn.oes.ejb.entity.clerk	-	100%	100%	100%	
com.bcbsmn.oes.ejb.entity.forms	-	100%	100%	100%	
com.bcbsmn.oes.ejb.session.services.clerk	-	100%	100%	100%	



Health Monitor: Test Coverage Details

Clover coverage report - EJB component - 1.0

Coverage timestamp: Thu Oct 6 2005 18:31:23 EEST

[Overview](#) [Package](#) [File](#)

[FRAMES](#) [NO FRAMES](#)

file stats: LOC: 142 Methods: 4

NCLOC: 89 Classes: 1

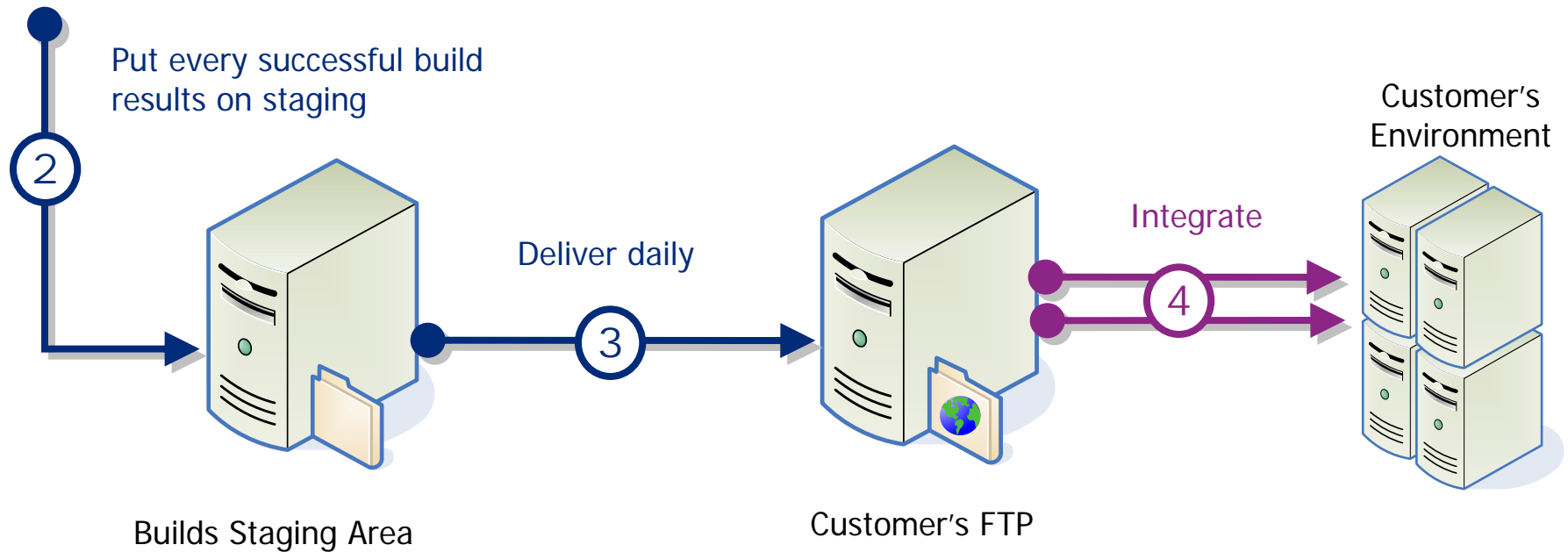
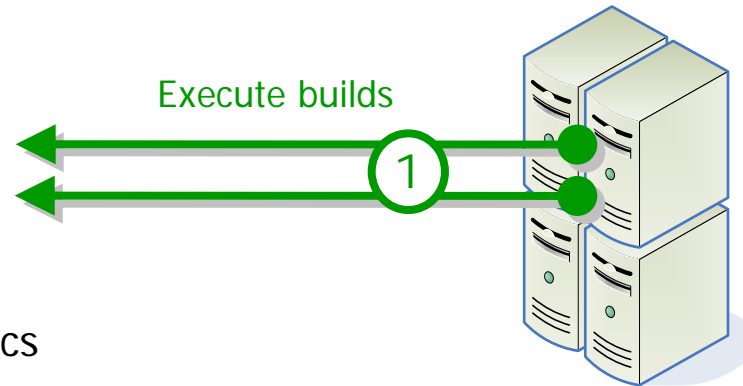
Source file	Conditionals	Statements	Methods	TOTAL
PersonDtoUtils.java	94.4%	100%	75%	96.8%

```
1  /*
2  * Copyright (c) 2005 EPAM Systems.
3  * All rights reserved.
4  */
5  package com.bcbsmn.oes.ejb.session.services.utils;
6
7  import com.bcbsmn.oes.dto.UserDTO;
8  import com.bcbsmn.oes.dto.applicant.PersonDTO;
9  import com.bcbsmn.oes.ejb.entity.applicant.IApplicantL;
10 import com.bcbsmn.oes.ejb.entity.applicant.IPersonL;
11 import com.bcbsmn.oes.ejb.entity.applicant.IPersonStatusL;
12 import com.bcbsmn.oes.ejb.entity.applicant.IPersonTypeL;
13 import com.bcbsmn.oes.ejb.entity.applicant.IPinTypeL;
14 import com.bcbsmn.oes.utils.DateUtils;
15
16 /**
17  * Utility class for operations with Person information DTO Allows bean to dto
18  * and vice verca conversion.
19  *
20  * @author Andrei Kubarkou
21  * @since 1.0
22  */
23 public final class PersonDtoUtils
24 {
25     /** Holds the customPinType identifier. */
26     private static final long CUSTOM_PIN_TYPE = 3;
27
28     /**
29      * Creates a new PersonDtoUtils object. Designed private to prevent this
30      * class of having instances.
31      */
32     0 private PersonDtoUtils()
33     {
34     }
35
36     /**
37      * Copies persistent bean information to transient DTO object.
38      *
39      * @param src persistent entity bean from which data has to be copied
40      * @param dest transient DTO to which data has to be copied
41      */
42     64 public static void beanToDto(final IPersonL src,
43                                 final PersonDTO dest)
44     {
```



Automated Delivery Made Possible

1. Compile
2. Assemble
3. Deploy
4. Test
5. Gather Statistics



EPAM Build Engineering Team: Make it a Pattern

EPAM invests into a dedicated Build Engineering Team (BET) to:

- Research, generalize and tailor CI practices to the company specifics on both Java and .NET platforms
- Develop custom tools and plug-ins to accommodate specific needs
- Create a shared repository of reusable CI artifacts (build/assembly scripts, reports style-sheets, master configurations)
- Put together CI environment templates for typical Java/.NET projects
- Formalize practices and enforce it as a part of Software Development Process



EPAM Build Engineering Team: Dashboard

BET - Project List (12 found)

v0.2.3, 23
BET - Measurement List (5 found)

Project I
KpiTypesPerBuildPieChart.do (PNG Im...

checkstyle subtypes in build 1590:kof-asm-trunk-20050609-180821

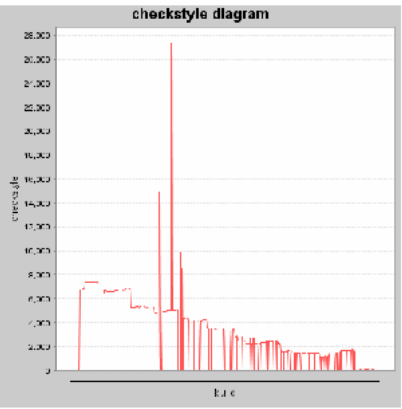
BET - Build List (587 found)

v0.2.3, 23th June 2005
Projects Modules Builds Files Persons Measurements Help Logout

Project 3:KOF-ASM - Build List (587 found)

Diagram: [checkstyle](#) | [junit](#) | [codechange](#) | [jcoverage](#) | [pmd](#) | [clover](#)

checkstyle diagram



checkstyle diagram

NAME	START	DURATION	LOG	files
kof-asm-trunk-20050610-110639	2005.06.10 11:06	13:09	OK	
checkstyle:	21 13.29%	codechange: 16	pmd: 9	
junit:	1623 100.00%	jcoverage: 0	clover: 93.96%	
kof-asm-daily-20050610-104256	2005.06.10 10:42	09:05	OK	
checkstyle:	21 13.29%	codechange: 1	pmd: 9	
junit:	1623 100.00%	jcoverage: 0	clover: 93.96%	
kof-asm-daily-20050610-095747	2005.06.10 09:57	10:26	OK	
checkstyle:	21 13.29%	codechange: 8	pmd: 9	
junit:	877 100.00%	jcoverage: 0	clover: 92.36%	
kof-asm-daily-20050610-092117	2005.06.10 09:21	18:51	OK	
checkstyle:	21 13.29%	codechange: 7	pmd: 9	
junit:	0 N/A	jcoverage: 0	clover: 0.00%	
kof-asm-daily-20050609-220022	2005.06.09 22:00	11:16	OK	
checkstyle:	21 13.29%	codechange: 398	pmd: 9	
junit:	1623 99.69%	jcoverage: 0	clover: 93.96%	
kof-asm-trunk-20050609-191032	2005.06.09 19:10	06:10	OK	
checkstyle:	21 13.29%	codechange: 1	pmd: 9	
junit:	1623 99.69%	jcoverage: 0	clover: 93.96%	
kof-asm-trunk-20050609-185247	2005.06.09 18:52	06:08	OK	
checkstyle:	21 13.29%	codechange: 367	pmd: 9	
junit:	0 N/A	jcoverage: 0	clover: 0.00%	

Search Box

ProjectId:

NameLike:

Severity Level:



Continuous Integration: Conclusions

- Conclusion #1: Automate your build process
- Conclusion #2: Get the health monitor
- Conclusion #3: Create it once and keep it up
- Conclusion #4: Automate your Delivery
- Conclusion #5: Make it a Pattern!





Delivering Excellence in Software Engineering



Continuous Integration – a way to successful Delivery

For more information, please contact:

Pavel Veller
Software Engineering Manager
EPAM Systems, Inc.

Email: Pavel_Veller@epam.com

Phone: +375-17-210-1662

Fax: +375-17-210-1168

<http://www.epam.com>