



Continuous Integration



Sébastien Besson

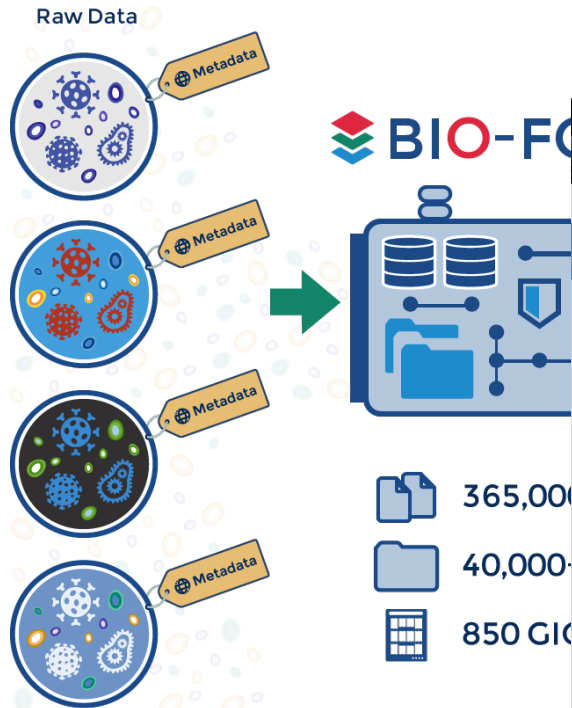
Open Microscopy Environment



Plan

1. What is Continuous integration?
2. Source code repository
3. Build and test automation
4. Continuous integration workflow

OMERO & BIO-FORMATS



Jason Swedlow's Data Manager

Projects

- Jason Swedlow
- Iain Porter
- Michael Porter
- Alexia Ferrand
- Analysis MCAK - GFP-MCAK cell line [8]
 - 101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0... [11]
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - ...101026-siRNA/101026-siCTL-GFP MCAK_SKIP_ACA_0...
 - 101026-siHP1a_LPM_M_total [11]
 - 101026-siHP1b_LPM_M_total [11]
 - 101026-siHP1g_LPM_M_total [12]
 - 101216-siCTL_LPM_M_total [12]
 - 101216-siHP1a_LPM_M_total [12]
 - 101216-siHP1b_LPM_M_total [9]
 - 101216-siHP1g_LPM_M_total [11]
 - Analysis Sgo2 [24]
 - Analysis Sgo2 PP2A-A a/b [12]
 - Analysis siSgo2_Sgo1RD_Sgo2Cys5 [6]
 - DYRK1A-Ibr [2]
 - DYRK1A-Ibr test [3]
 - DYRK1A_fragments [5]
 - Embryos [1]
 - Fip-in cell lines [5]
 - HeLaSPM_MNB [1]
 - HeLaMNB [19]
 - HP1 [47]
 - Jenny [6]
- Screens
- Attachments
- Tags
- Images
- Search

Workspace: 11 of 11 images

filter images

Image ID: 3840635
Description: ...GFP MCAK_SKIP

Acquired Imported
Dimensions (XY)
Pixel Type
Pixels Size (XYZ) (µm)
z-sections/timepoints
Channels

Annotations

rate
tag
attachment

Comments

Alexia Ferrand 11/9/10 2:16 PM
for fig siCTL VS siMCAK

Alexia Ferrand 11/9/10 2:13 PM
gfp 6000 instead of 1000s

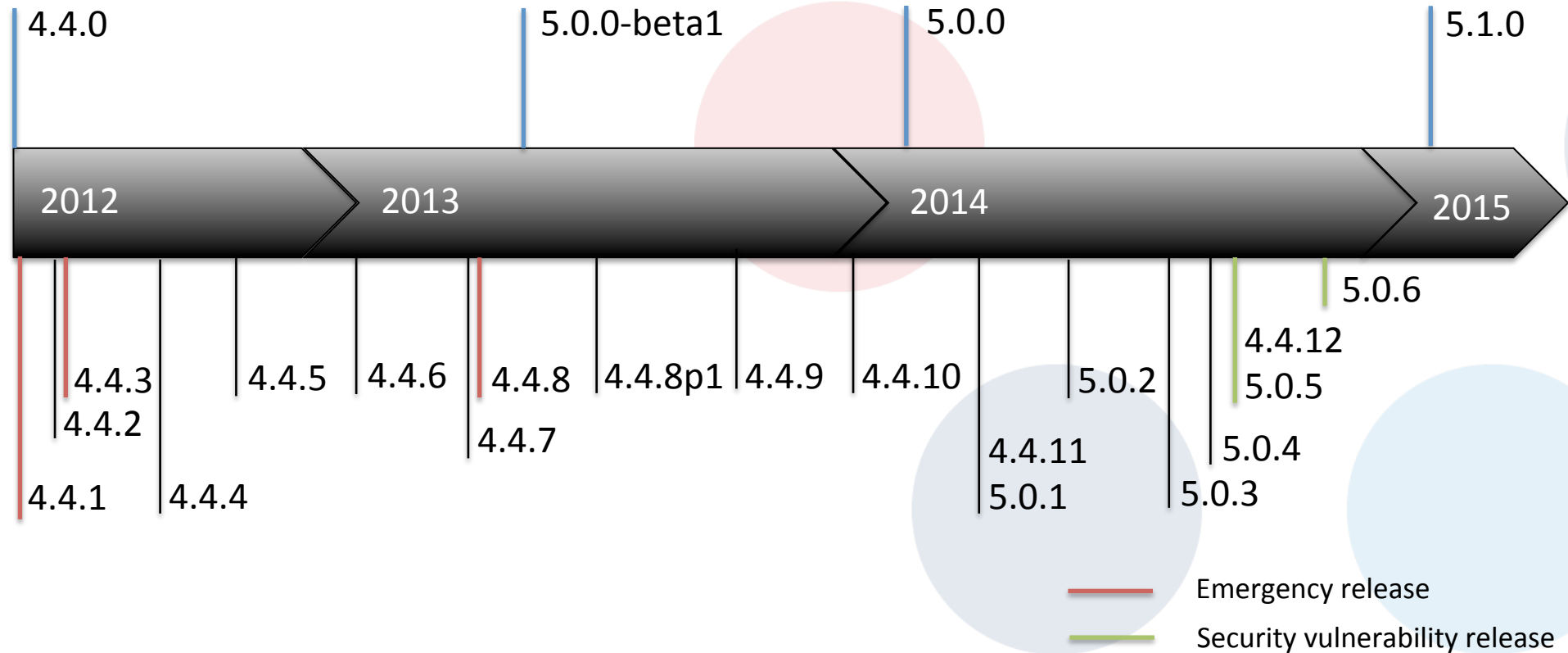
Contained in Datasets

ROI	id	T	Z	Type	Text	Visible
	5662	[1,1]	[1,60]	<input type="checkbox"/>		<input type="checkbox"/>
	5663	[1,1]	[1,60]	<input type="checkbox"/>		<input type="checkbox"/>
	5664	[1,1]	[1,60]	<input type="checkbox"/>		<input checked="" type="checkbox"/>



Open- Source Community

OME release cycle



Distribution to a large open-source community with heterogeneous needs/usage

The problem

- Quality Assurance
- Integrating new features
- Fixing bugs
- Large team (~20 people) coordination

WHEN YOU HEAR THIS:



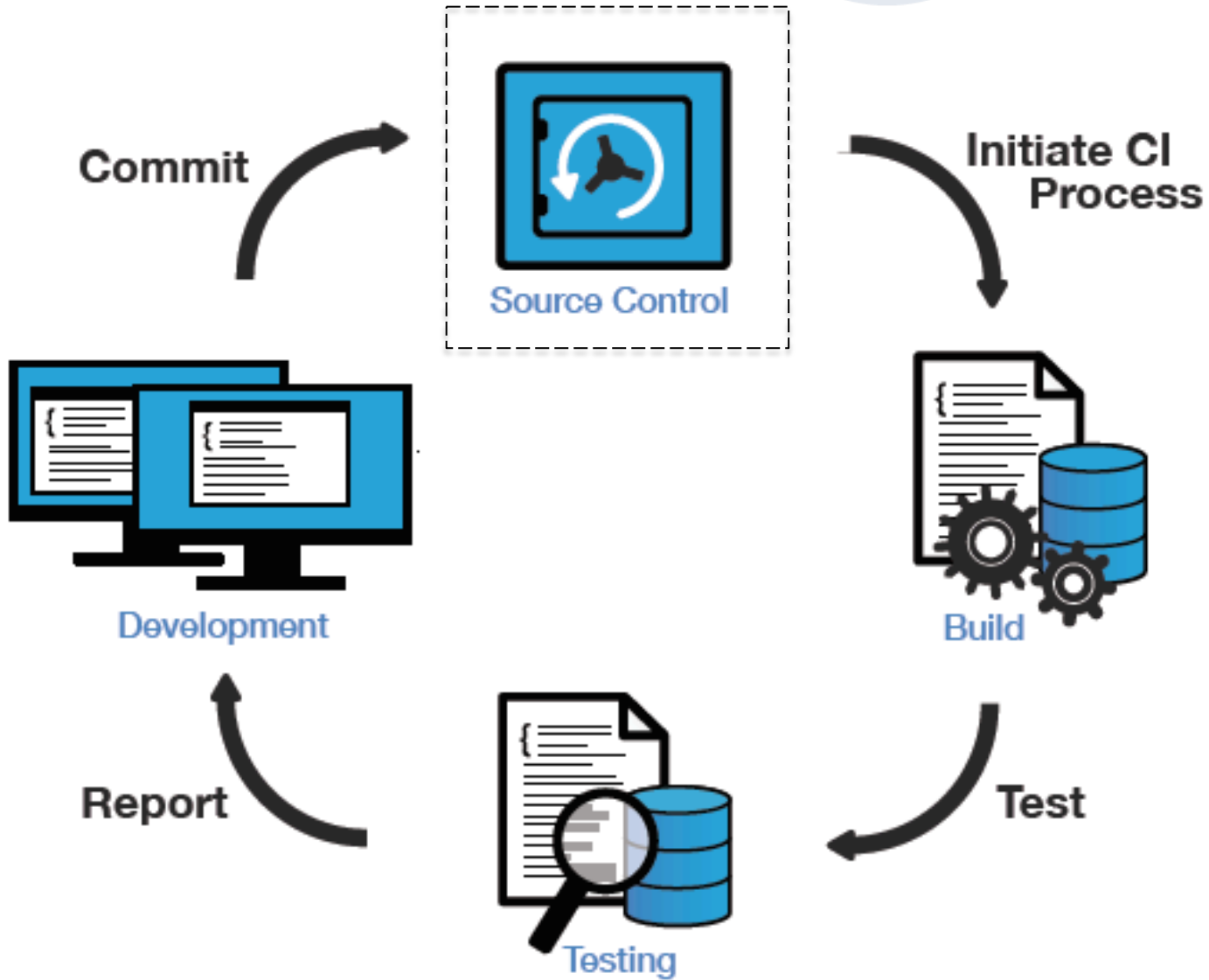
What's Continuous Integration?

*Continuous Integration is a software development practice where members of a team **integrate** their work **frequently**, usually each person integrates at least daily - leading to multiple integrations per day.*

*Each integration is verified by an **automated build** (including **test**) to detect integration errors as quickly as possible. Many teams find that this approach leads to significantly reduced integration problems and allows a team to **develop cohesive software** more rapidly.*

-- Martin Fowler

Continuous integration



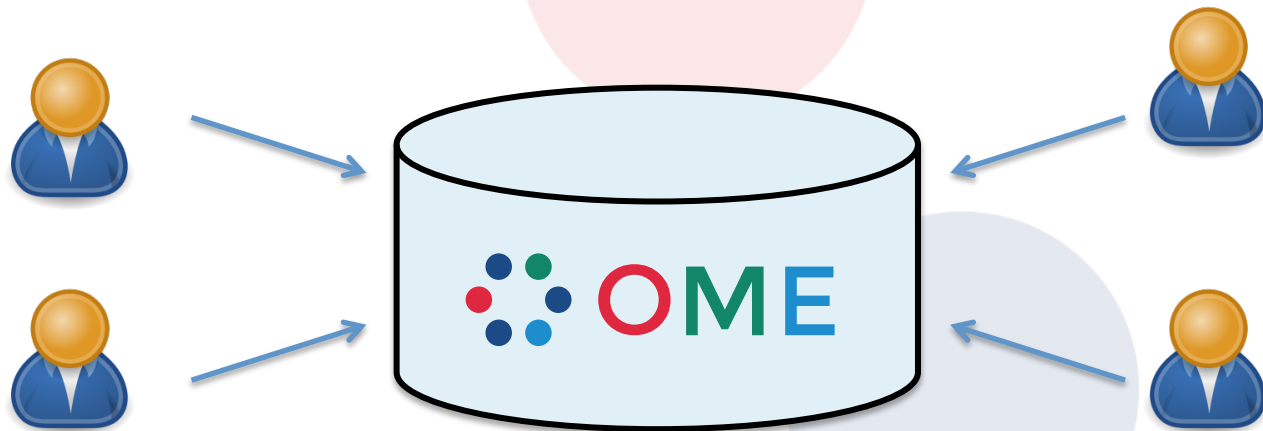
Deliverables



- OMERO.server / OMERO.clients
 - Windows, Linux, Mac OS X
 - Ice (3.4, 3.5)
 - Tools/plugins
 - OMERO.imagej, OMERO.matlab, OMERO.py
 - OMERO Virtual appliance
 - Documentation
 - API documentation
 - Technical documentation
 - User help documentation
- Java ARchives (JAR)
 - bioformats_package.jar
 - formats_api.jar
 -
 - Bio-Formats Tools
 - Command-line tools
 - MATLAB toolbox
 - Bio-Formats C++
 - Documentation
 - API documentation
 - Sphinx documentation

Source Code Repository

- All deliverables generated from code base
- Maintain a centralized code base repository



- Version control: keep track of every change in the code base

Source Code Repository: OME

- Version Control software: Subversion, Git, Mercurial...
- Git / GitHub

The screenshot shows the GitHub web interface for the 'Open Microscopy Environment' repository. The browser address bar displays 'https://github.com/openmicroscopy'. The repository page includes a search bar, navigation links (Explore, Gist, Blog, Help), and a user profile for 'sbesson'. The main content area features the repository name 'Open Microscopy Environment' with a description: 'Software and data format standards for management of microscopy image data. Joint project between international private and public research'. Below this, there are filters and a search bar for repositories. Three repositories are listed: 'openmicroscopy' (Java, 63 stars, 59 forks), 'backup-trello' (Python, 0 stars, 2 forks), and 'bioformats' (Java, 65 stars, 95 forks). Each repository entry includes a brief description and a commit history bar. On the right side, there are sections for 'People' (46 members) and 'Teams' (10 teams), each with a search bar and a list of team members and repositories.

Source code repository: Pull Requests

The screenshot shows a GitHub Pull Request (PR) page for the repository 'openmicroscopy/openmicroscopy'. The PR is titled 'assist #11091: refactor server DB queries for hierarchy navigation by mtbc' and is currently open. It shows 8 commits and 7 files changed. The PR description includes a detailed explanation of the changes and a Travis CI build status of 'All is well'.

PR Summary:

- Title:** assist #11091: refactor server DB queries for hierarchy navigation
- Status:** Open
- Commits:** 8
- Files Changed:** 7
- Progress:** 788 (indicated by a progress bar)
- Issue:** #2005

Description:

mtbc opened this pull request a day ago

No one is assigned No milestone

Fixes step one of <http://trac.openmicroscopy.org.uk/ome/ticket/11091> and prepares the way for <http://trac.openmicroscopy.org.uk/ome/ticket/11019>. Batches and caches bulk DB queries for hierarchy navigation and has preprocessor and container service use the same query code. (Increases allocation of small Java objects to reduce traffic with DB and increase code reusability.)

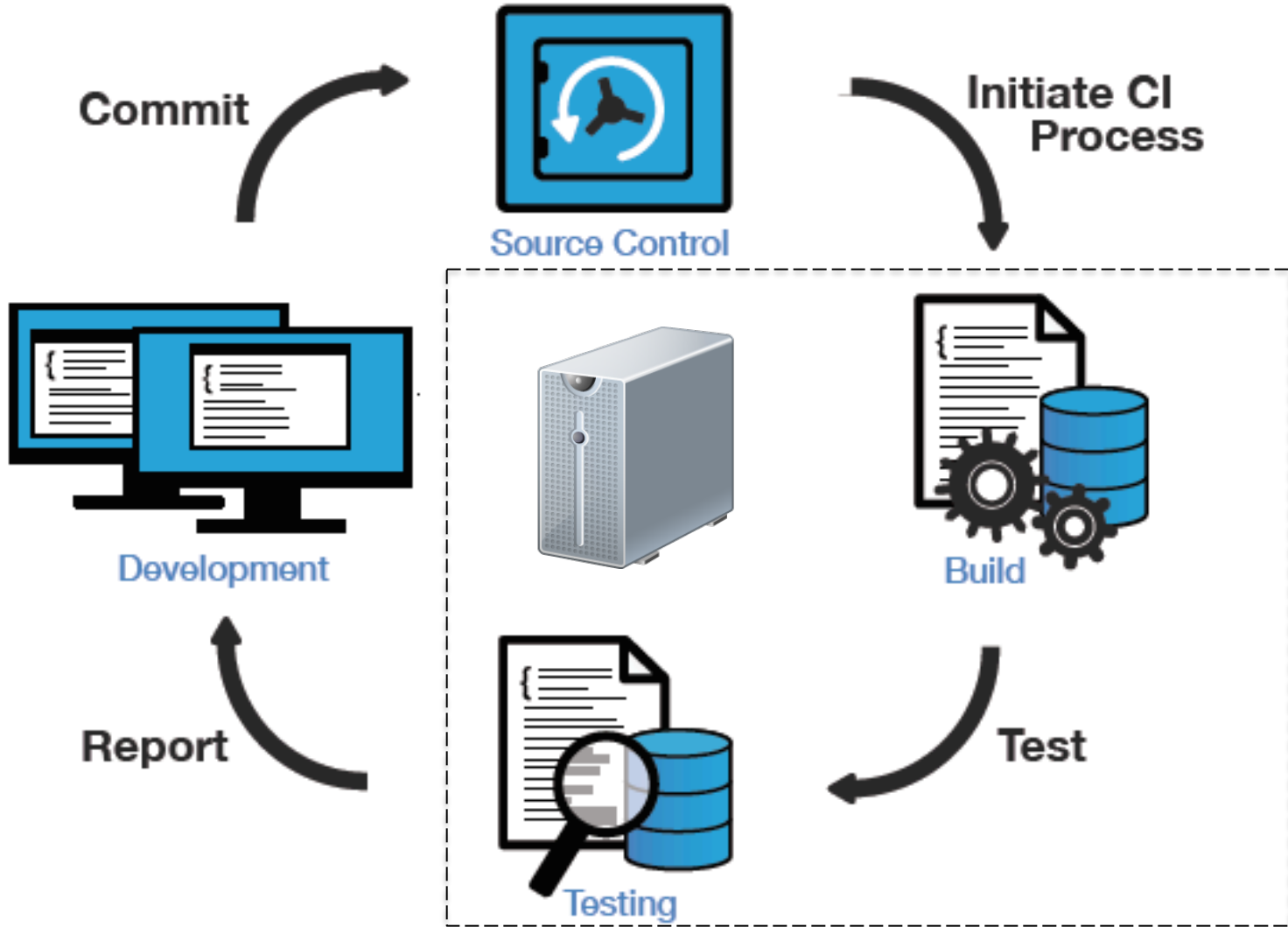
To test, check for regressions in behavior that relies on graph traversal, including filesset splitting.

Build Status: ✓ All is well — The Travis CI build passed ([Details](#))

Commits:

Author	Commit Message	SHA-1
mtbc	create a simple cache for storing model hierarchy lookups	eb1f4f7
mtbc	create simple methods in a base class for model hierarchy navigation	c7e8c8a
mtbc	create a wrapper for hierarchy navigation using different types	d0966e9
mtbc	adjust PojosImpl to use hierarchy navigator	f18ddb5
mtbc	change preprocessor to use hierarchy navigator	5e3d449
mtbc	adjust do-all for change in preprocessor constructor	107ac1c
mtbc	update preprocessor test class with latest changes	✓ 47691c2
mtbc	remove weird rebase artifact	✓ a83c300

Continuous integration



Jenkins CI

The screenshot shows the Jenkins CI web interface for the Open Microscopy Environment project. The main content is a table of build jobs, with columns for status, name, last success, last failure, last duration, console, and cron trigger. The left sidebar contains navigation links and build queue information.

Continuous build & integration system for the Open Microscopy Environment project.

S	W	Name	Last Success	Last Failure	Last Duration	Console	Cron Trigger
		OMERO-5.1-merge-build	12 hr - #379	1 mo 11 days - #350	1 hr 18 min		
		BIOFORMATS-5.1-latest	2 hr 41 min - #253	8 mo 17 days - #64	24 min		Poll SCM: H * * * *
		BIOFORMATS-5.1-latest-cpp	1 mo 4 days - #210	1 mo 4 days - #209	6 hr 48 min		<i>(Disabled)</i> Poll SCM: @daily
		BIOFORMATS-5.1-latest-cppwrap	1 hr 57 min - #254	2 hr 13 min - #253	36 min		
		BIOFORMATS-5.1-latest-docs-autogen	2 hr 17 min - #255	7 mo 21 days - #69	23 min		
		BIOFORMATS-5.1-latest-maven	2 hr 17 min - #242	N/A	4 min 1 sec		
		BIOFORMATS-5.1-latest-win	3 hr 15 min - #142	23 hr - #141	1 hr 50 min		Poll SCM: H * * * *
		BIOFORMATS-5.1-merge-build	10 hr - #633	1 mo 3 days - #585	38 min		
		BIOFORMATS-5.1-merge-build-win	10 hr - #457	1 mo 4 days - #408	1 hr 54 min		
		BIOFORMATS-5.1-merge-cpp	10 hr - #518	8 days 4 hr - #503	2 hr 10 min		
		BIOFORMATS-5.1-merge-daily	19 hr - #314	3 mo 14 days - #212	8 min 11 sec		Build periodically: H 20 * * *
		BIOFORMATS-5.1-merge-docs	10 hr - #632	4 days 23 hr - #621	36 min		
		BIOFORMATS-5.1-merge-docs-autogen	19 hr - #158	1 day 19 hr - #157	24 min		
		BIOFORMATS-5.1-merge-full-repository	2 days 7 hr - #361	1 day 7 hr - #362	15 hr		Build periodically: H 8 * * *

Build Queue

- OMERO-5.1-latest-cpp-win
- FLIMfit-latest-mac
- DOCKER-build
- DOCKER-report

Build Executor Status

#	Status
10.2.1.194	
1	Idle
2	Idle
Beluga (offline)	
git.openmicroscopy.org	
1	Idle
2	Idle
3	Idle
4	Idle
gretzky35	
1	Idle
2	Idle

Build system

- Generate deliverables from code base
- Build tools: Shell scripts, Maven, Ant, CMake...
- Generate a standalone binary with a single command line



- Build OMERO.server
 - \$./build.py build-default
- Build API documentation
 - \$./build.py release-sphinx-api



- Build JARs
 - \$ ant jars
- Build Javadoc
 - \$ ant docs-sphinx

Build artifacts

The screenshot displays the Jenkins Configuration page for the job `3.4,7_LATEST,trout`. The page is divided into several sections:

- Navigation:** Includes links for [Back to Dashboard](#), [Status](#), [Changes](#), [Metadata](#), [Failure Scan Options](#), and [Javadoc](#).
- Build History:** A table showing the last 10 successful builds, each with a green status icon, build number, and timestamp.

Build Number	Timestamp
#379	Jan 13, 2015 3:53:00 AM
#378	Jan 12, 2015 3:50:29 AM
#377	Jan 9, 2015 3:50:33 AM
#376	Jan 8, 2015 3:50:59 AM
#375	Jan 7, 2015 3:50:47 AM
#374	Jan 6, 2015 3:50:13 AM
#373	Jan 5, 2015 3:49:35 AM
#372	Jan 2, 2015 3:49:04 AM
#371	Jan 1, 2015 3:49:12 AM
#370	Dec 26, 2014 3:48:51 AM
- Configuration:** Shows the `Javadoc` configuration with a `src/target` directory tree containing various artifacts like `develop.log`, `GIT_INFO`, and multiple `OMERO` client and server zip files for different operating systems (linux, mac, win).
- Warnings:** Two **Cobol Warnings Trend** charts are displayed, both showing a count of 0 for all build numbers from #361 to #379.

Test

- Manual QA testing for each code submission
- Automated testing
 - OMERO server, OMERO clients, Bio-Formats
 - Unit/integration tests
- Testing framework: TestNG, Robot framework, pytest...
- Example:
 - addition of a new method to the API
 - addition of corresponding integration tests testing the method logic, various inputs, scenarios...

OMERO server integration tests

The screenshot shows the Jenkins web interface for the project 'OMERO-5.1-merge-integration-python'. The browser address bar shows 'ci.openmicroscopy.org/job/OMERO-5.1-merge-integration-python/'. The Jenkins logo is in the top left, and a search bar and 'log in' link are in the top right. Below the header, there are navigation links: 'Back to Dashboard', 'Status', 'Changes', 'Trac', 'GitHub', 'Metadata', and 'Failure Scan Options'. The main content area is titled 'Project OMERO-5.1-merge-integration-python' and includes a link to 'Contributing' documentation. There are links for 'Recent Changes' and 'Latest Test Result (4 failures / +2)'. A 'Test Result Trend' chart shows a count of test results over time, with a significant spike in failures around January 13, 2015. Below the chart are links for '(just show failures) enlarge'. The 'Upstream Projects' section shows 'OMERO-5.1-merge-integration'. The 'Permalinks' section lists various build links, including the last build (#340) which failed 3 hours and 32 minutes ago. The 'Build History' table on the left lists builds from #325 to #340 with their respective dates and times.

ci.openmicroscopy.org/job/OMERO-5.1-merge-integration-python/

Jenkins

OMERO-5.1-merge-integration-python

Project OMERO-5.1-merge-integration-python

For more info, see the "[Contributing](#)" documentation.

[Recent Changes](#)

[Latest Test Result](#) (4 failures / +2)

Test Result Trend

(just show failures) enlarge

Upstream Projects

- OMERO-5.1-merge-integration

Permalinks

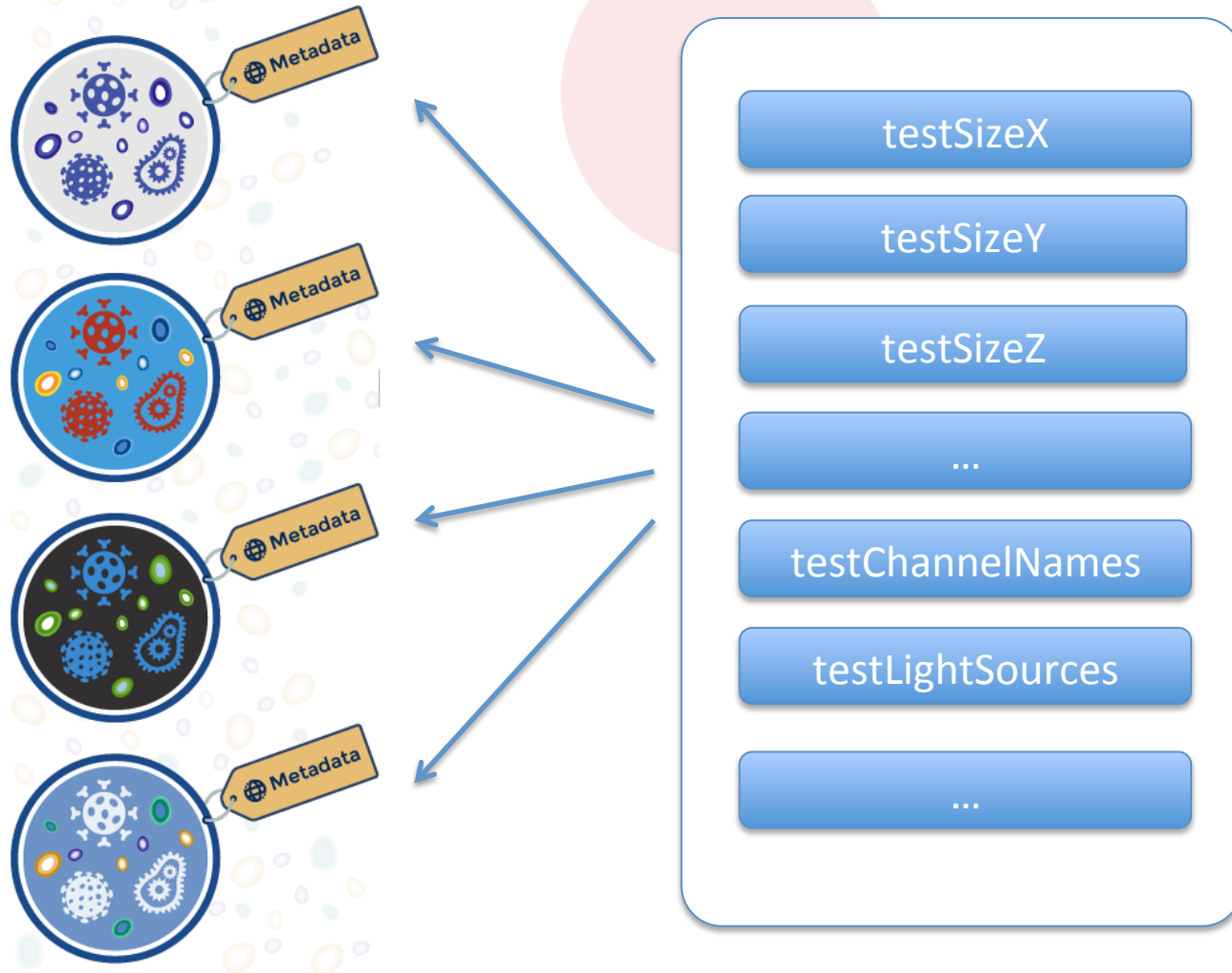
- Last build (#340), 3 hr 32 min ago
- Last stable build (#337), 5 days 8 hr ago
- Last successful build (#340), 3 hr 32 min ago
- Last failed build (#276), 2 mo 23 days ago
- Last unstable build (#340), 3 hr 32 min ago
- Last unsuccessful build (#340), 3 hr 32 min ago

Build History (trend)

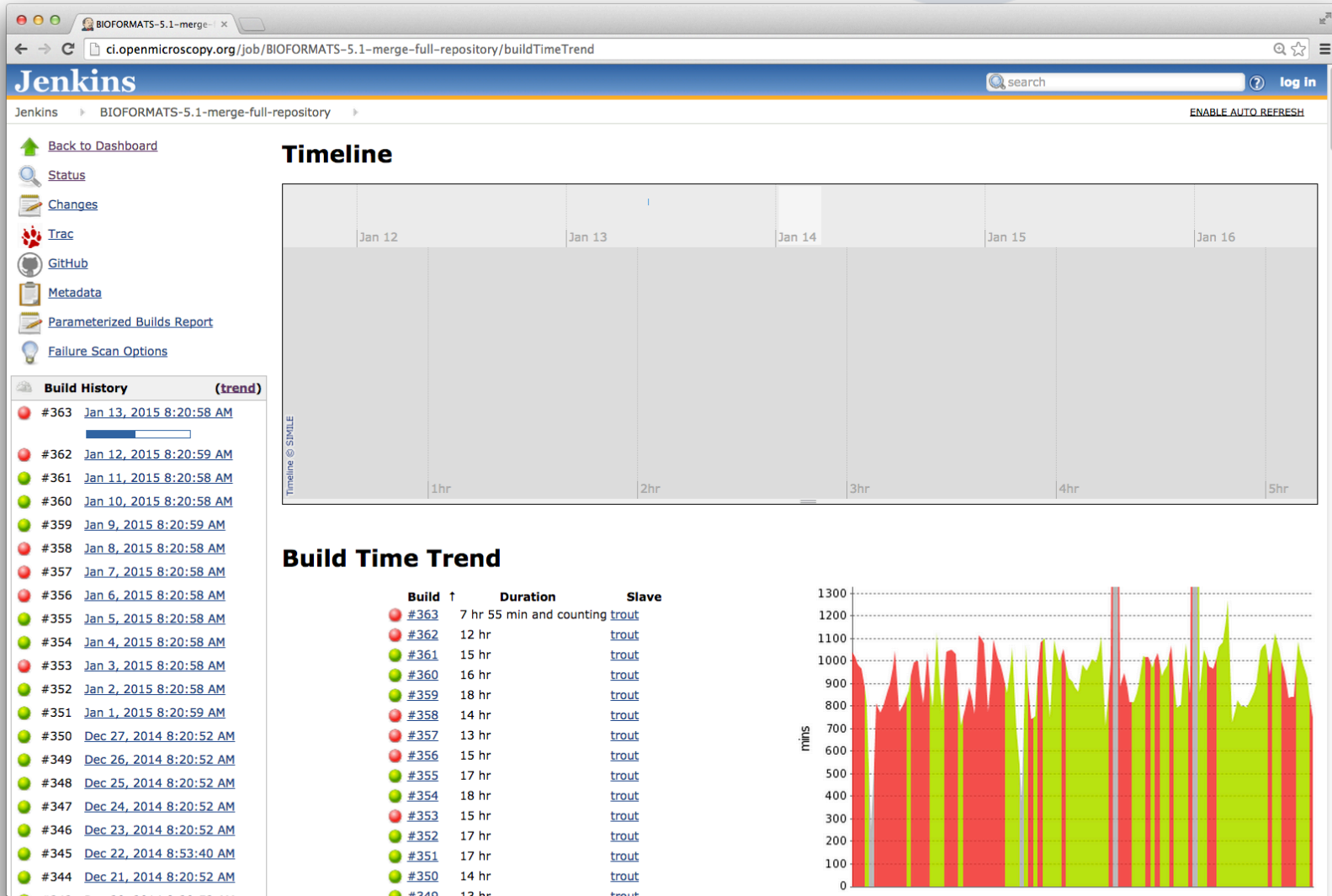
Build Number	Date and Time
#340	Jan 13, 2015 12:39:22 PM
#339	Jan 12, 2015 6:50:07 AM
#338	Jan 9, 2015 6:08:11 AM
#337	Jan 8, 2015 8:11:32 AM
#336	Jan 7, 2015 6:09:28 AM
#335	Jan 6, 2015 6:09:37 AM
#334	Jan 5, 2015 6:19:30 AM
#333	Jan 2, 2015 6:14:49 AM
#332	Jan 1, 2015 6:19:39 AM
#331	Dec 25, 2014 6:18:23 AM
#330	Dec 24, 2014 6:05:02 AM
#329	Dec 23, 2014 6:09:52 AM
#328	Dec 22, 2014 6:22:46 AM
#327	Dec 19, 2014 6:08:46 AM
#326	Dec 18, 2014 6:10:04 AM
#325	Dec 17, 2014 6:08:18 AM

Bio-Formats automated tests

Large repository of samples files for each supported format

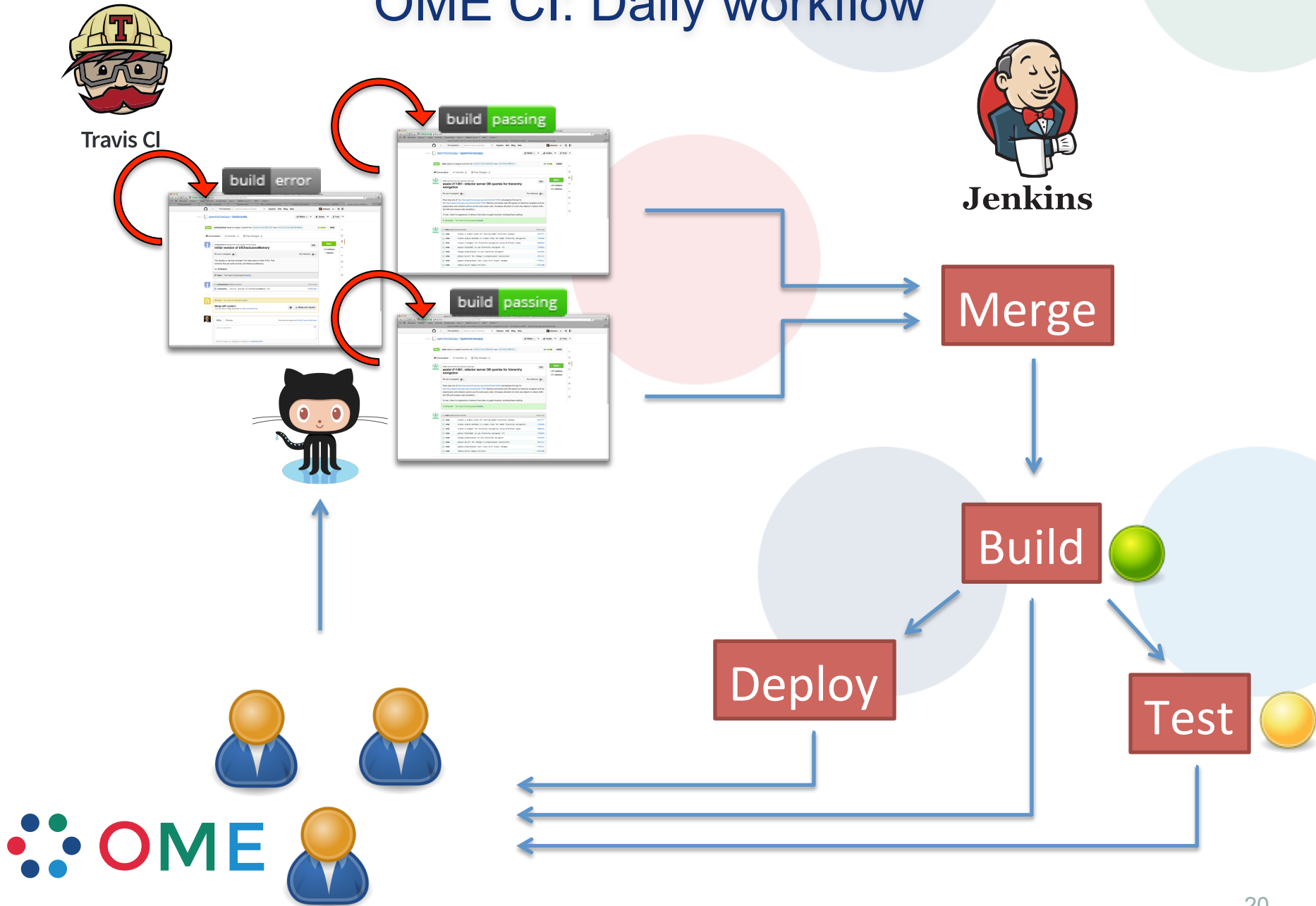


Bio-Formats automated tests (II)



12K files (1.8 TB), 300K tests, 12096m/12 threads

OME CI: Daily workflow



Future work: Environment matrix

- Multiple Operating Systems (Linux, Windows, OSX)
- Multiple prerequisite versions
 - Java 1.6, 1.7, 1.8
 - Python 2.6, 2.7
- Build/Deploy/Test under all supported environments
 - Build: Java 1.8 / Python 2.7 / Ice 3.4 ...
 - Deployment: PostgreSQL 8.4 / Python 2.6 / Ice 3.5 ...
- Integrating Docker into CI workflow



Acknowledgements



wellcometrust



Resources

- Source Control



Git

<http://git-scm.com/>



GitHub

<https://github.com/>

<https://github.com/openmicroscopy>

- Testing



Pytest

<http://pytest.org/latest/>



TestNG

<http://testng.org/doc/index.html>

TestNG



Robot framework

<http://robotframework.org/>

- Build



Ant

<http://ant.apache.org/>

maven

Maven

<http://maven.apache.org/>



Cmake

<http://www.cmake.org/>

- Continuous Integration/Deployment



Travis CI

Travis CI

<http://travis-ci.org/>

<https://travis-ci.org/openmicroscopy/>



Jenkins

Jenkins CI

<http://jenkins-ci.org/>

<http://ci.openmicroscopy.org>



docker

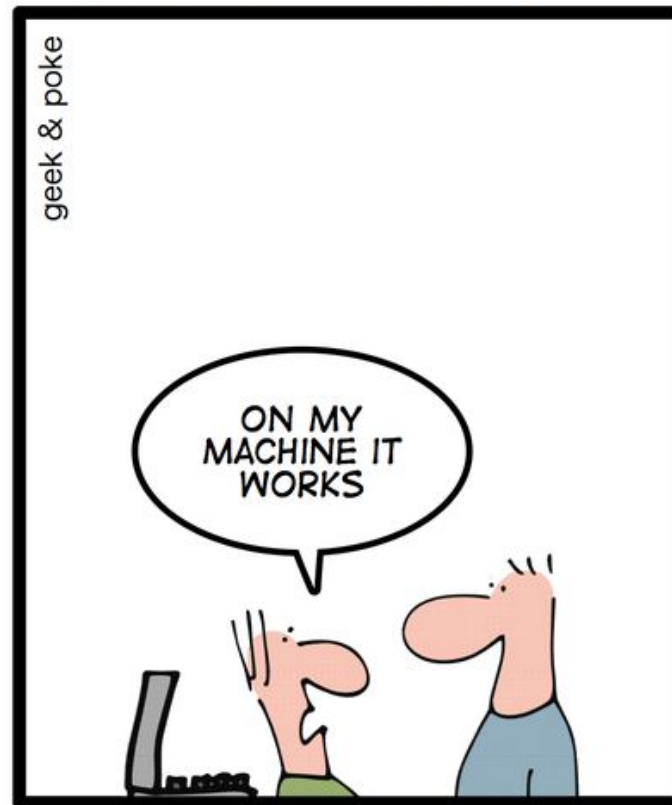
Docker

<https://www.docker.com/>

Continuous integration server

*JUST IN CASE YOU'RE STILL NOT
SURE WHETHER YOU'RE IN A
SOFTWARE PROJECT*

WAIT UNTIL YOU HEAR THIS:



Source code: changes frequency

	OMERO	Bio-Formats	Documentation	Scripts
Number of commits	5502	3033	1375	111
Number of merged Pull Requests	812	366	254	23
Number of unique authors	25	26	26	7
Number of merged Pull Requests/day	2	1	1	<1
Number of commits/day	11	6	3	<1

Changes on dev_5_0 branch between 25 Sept 2012 and 20 Jan 2014