Continuous Integration

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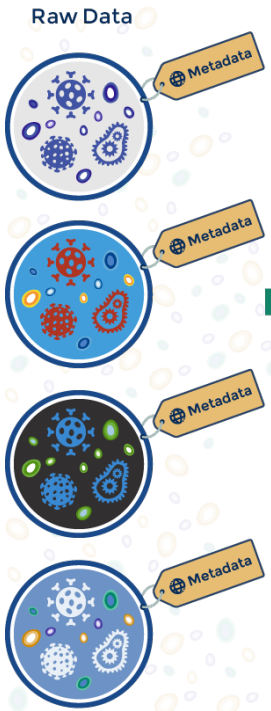
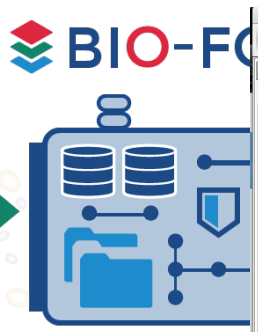
Plan

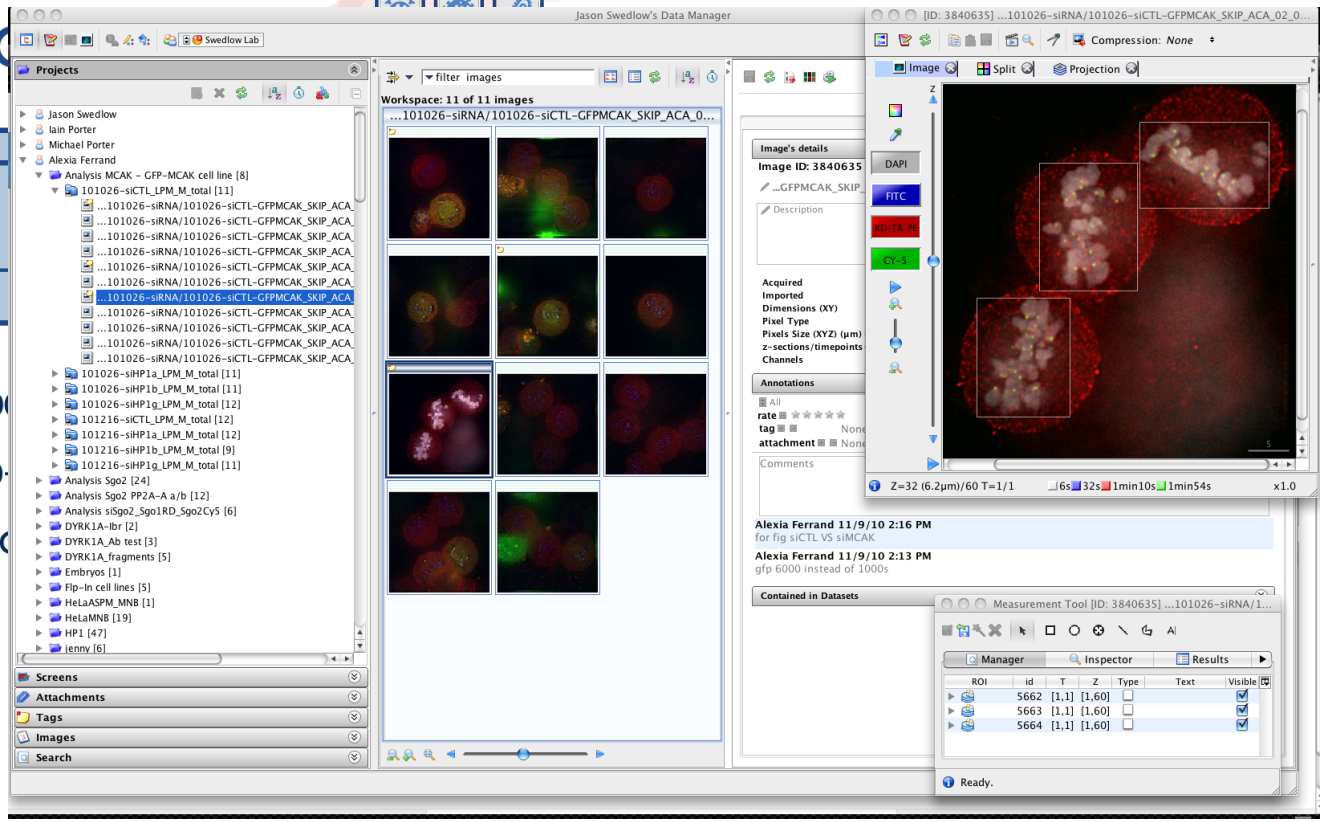
1. What is Continuous integration?
2. Source code repository
3. Build and test automation
4. Continuous integration workflow

OMERO & BIO-FORMATS



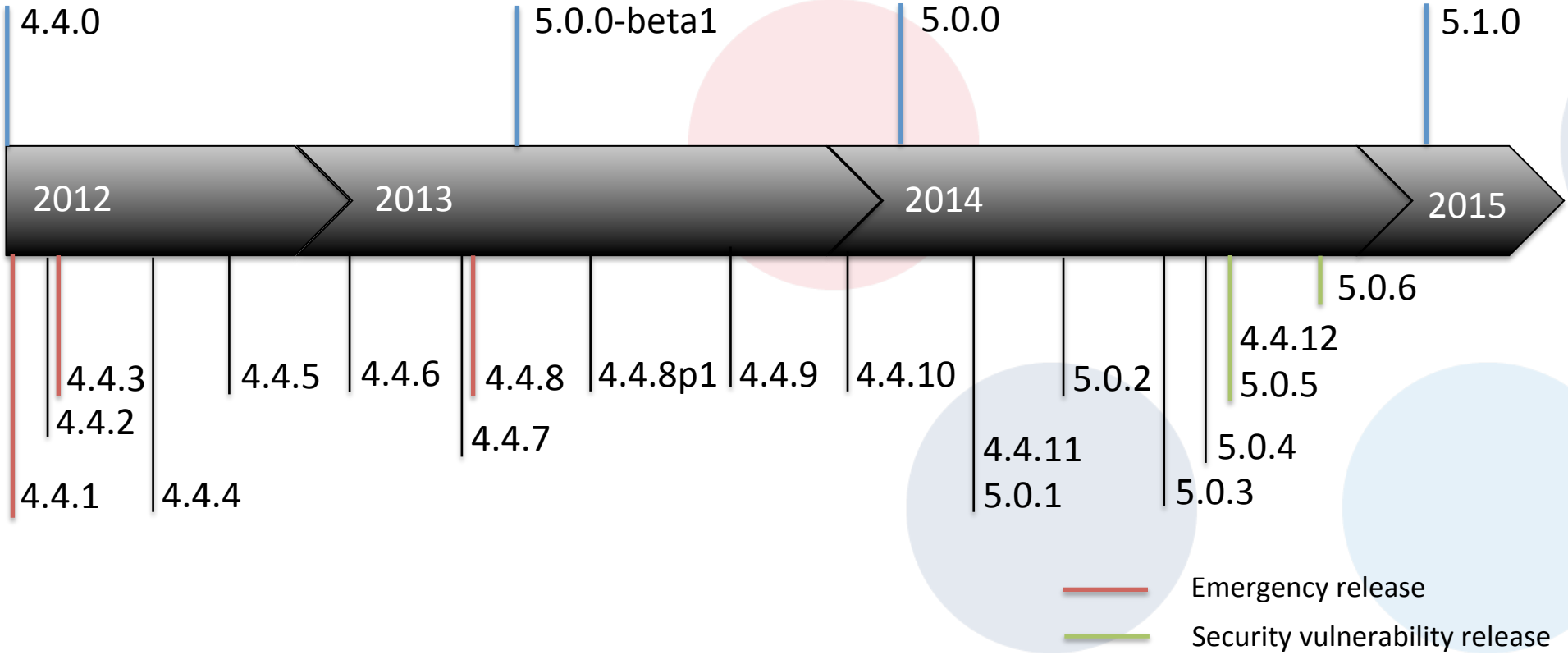


Processed Data



Open- Source Community

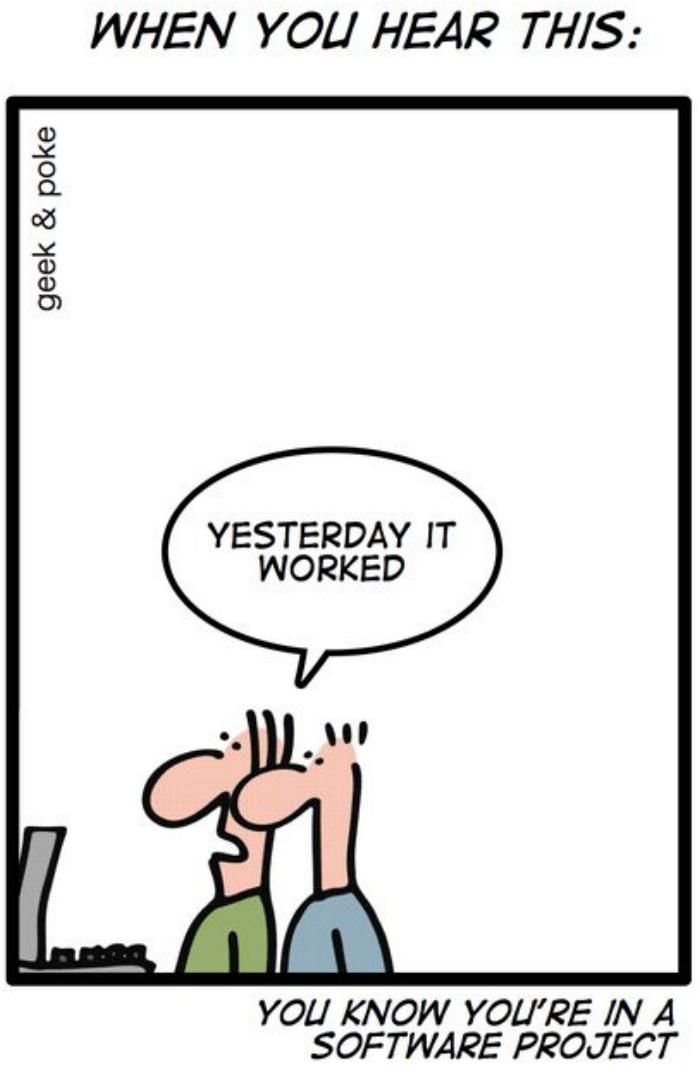
OME release cycle



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



http://geekandpoke.typepad.com

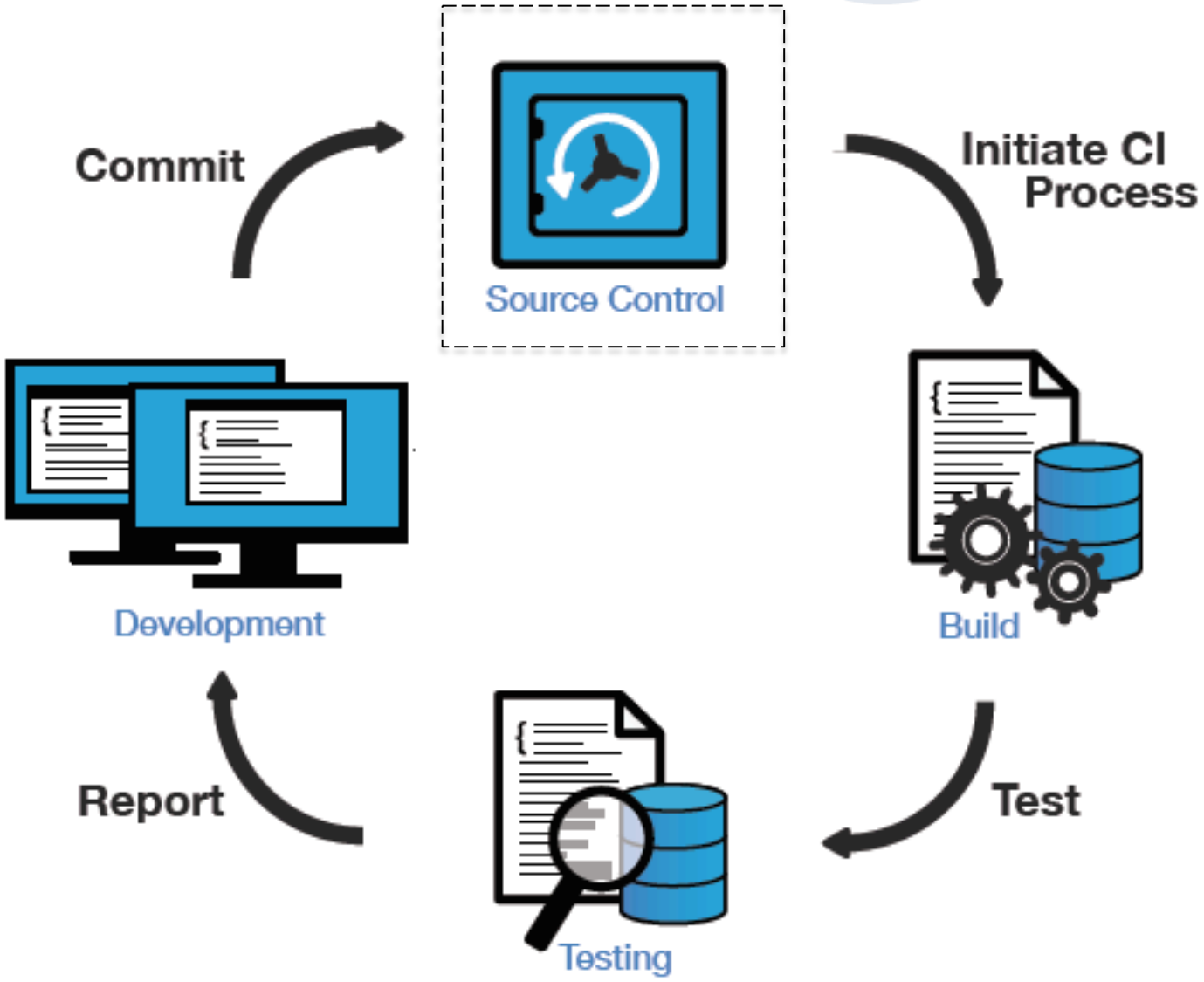
What's Continuous Integration?

*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

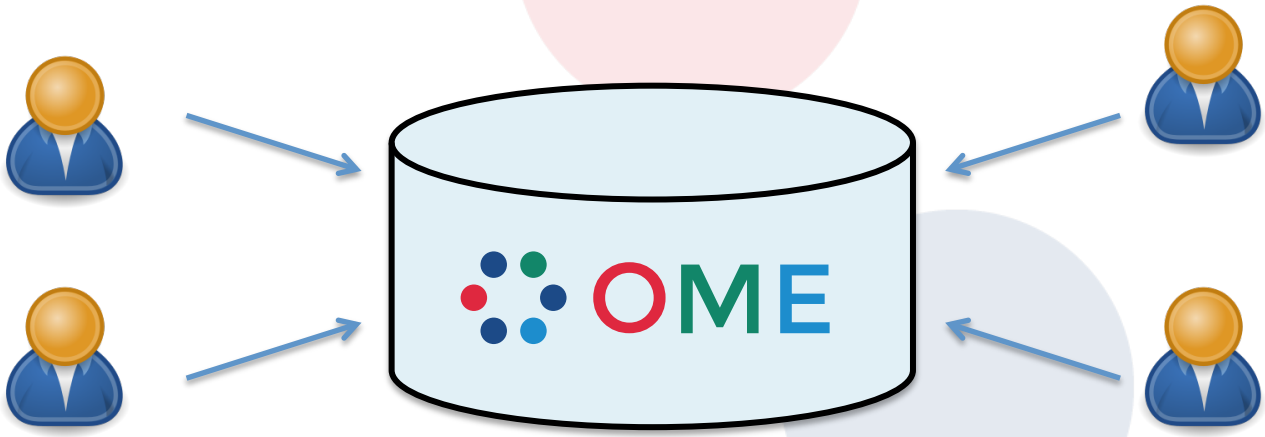
- OMERO.server / OMERO.clients
  - Windows, Linux, Mac OS X
  - Ice (3.4, 3.5)
- Tools/plugins
  - OMERO.imagej, OMERO.matlab, OMERO.py
- OMERO Virtual appliance
- Documentation
  - API documentation
  - Technical documentation
  - User help documentation

BIO-FORMATS

- 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

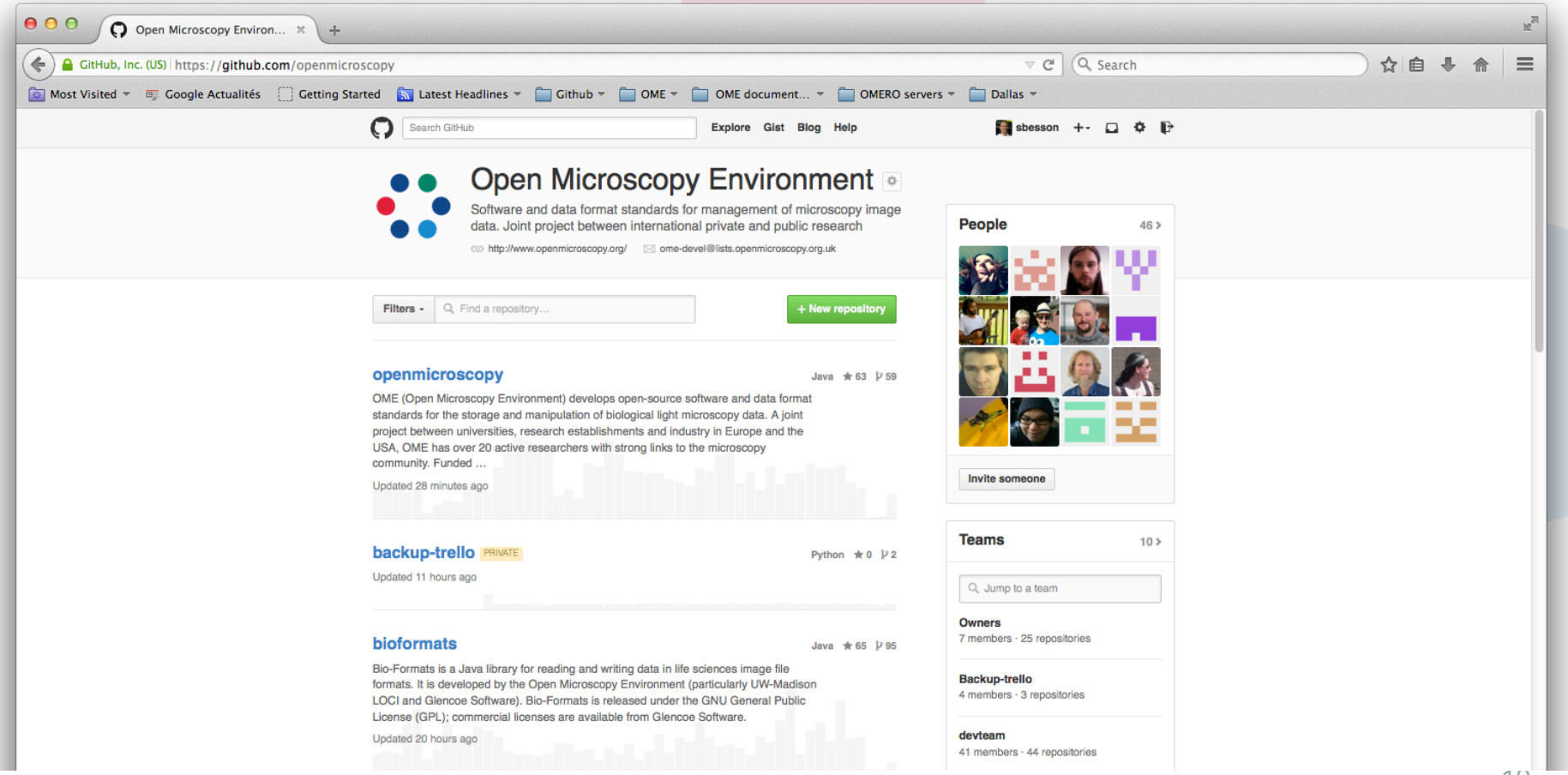
- All deliverables generated from code base
- Maintain a centralized code base repository



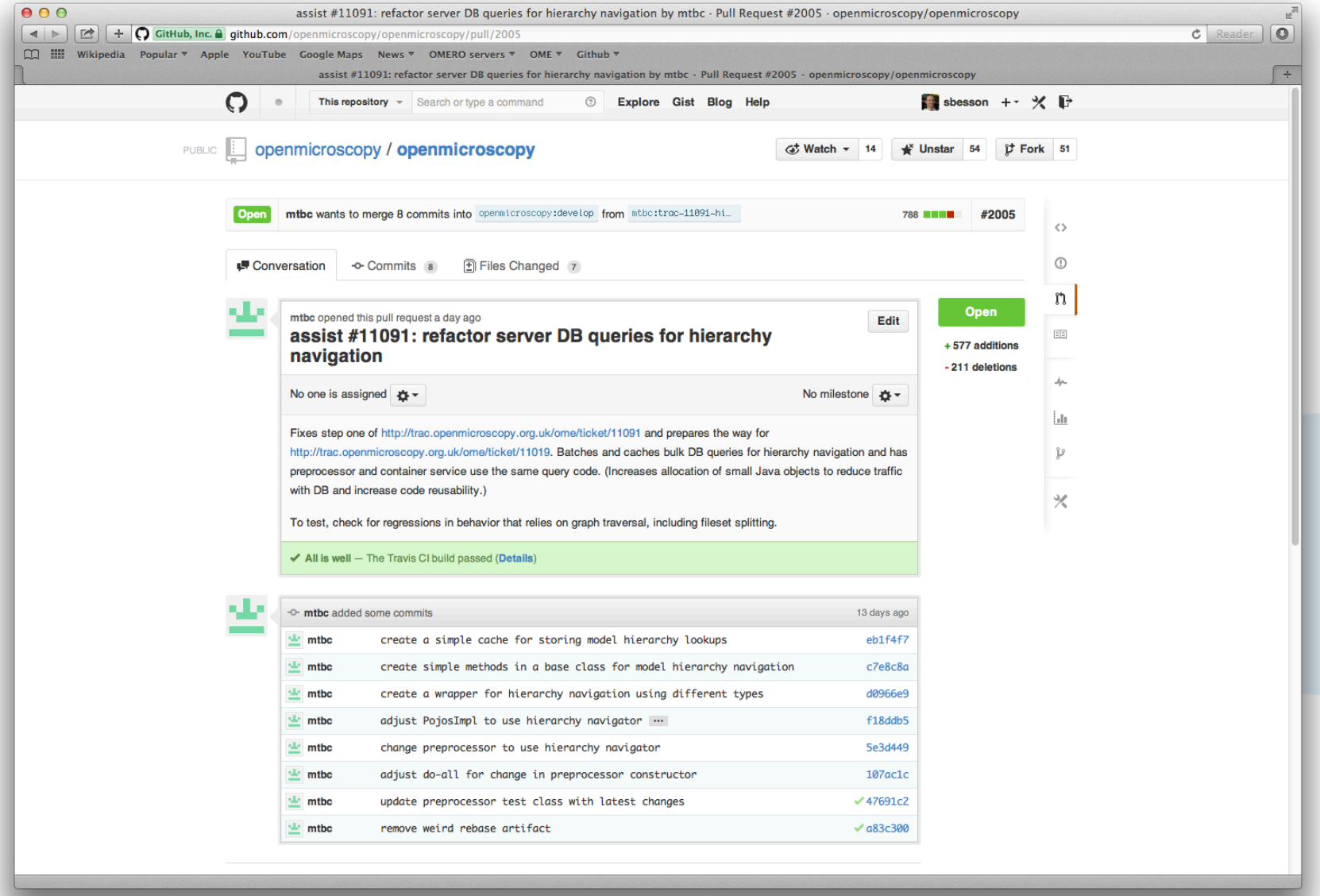
- Version control: keep track of every change in the code base

Source Code Repository: OME

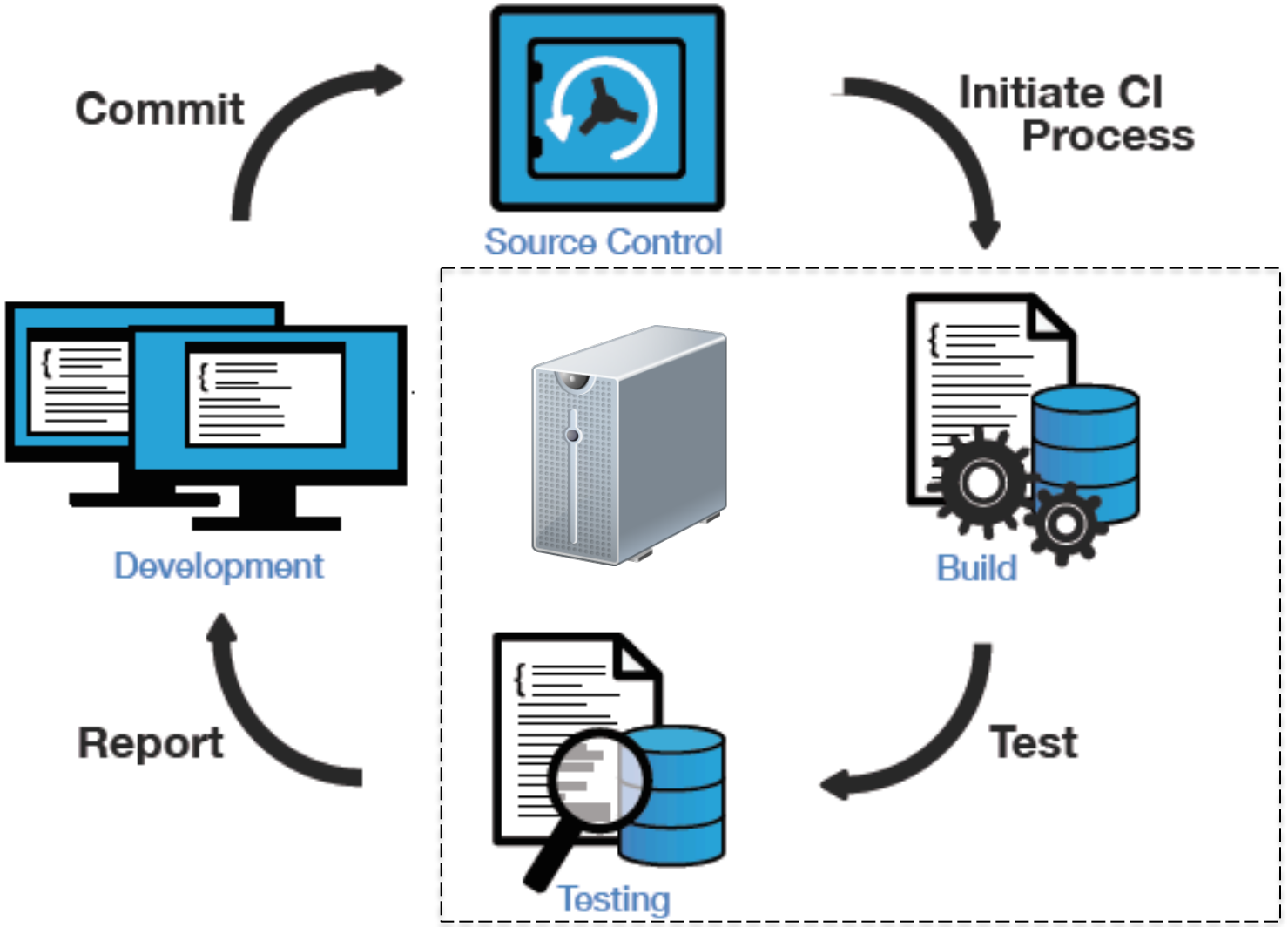
- Version Control software: Subversion, Git, Mercurial…
- Git / GitHub



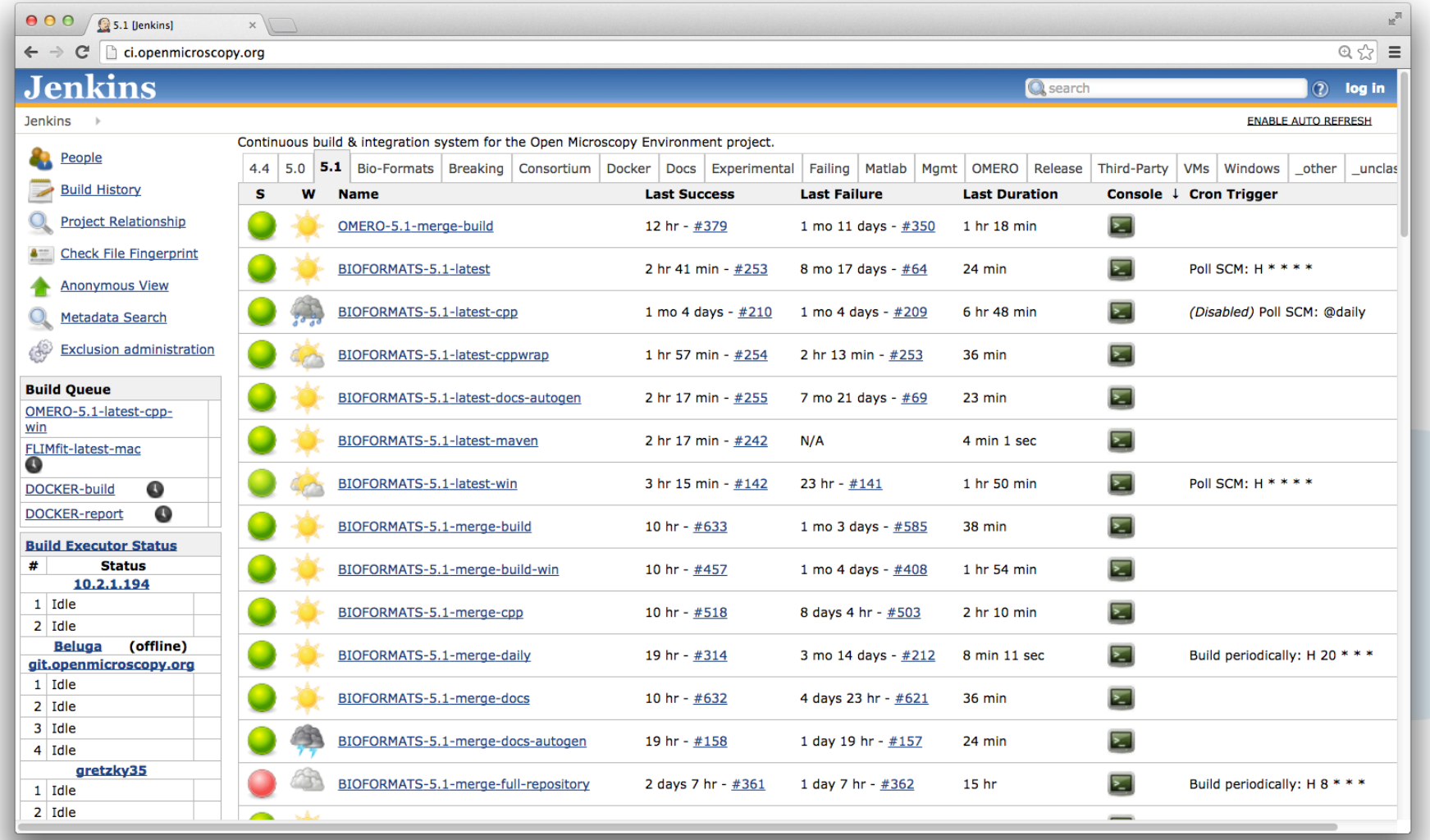
Source code repository: Pull Requests



Continuous integration



Jenkins CI



http://ci.openmicroscopy.org

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
  ```

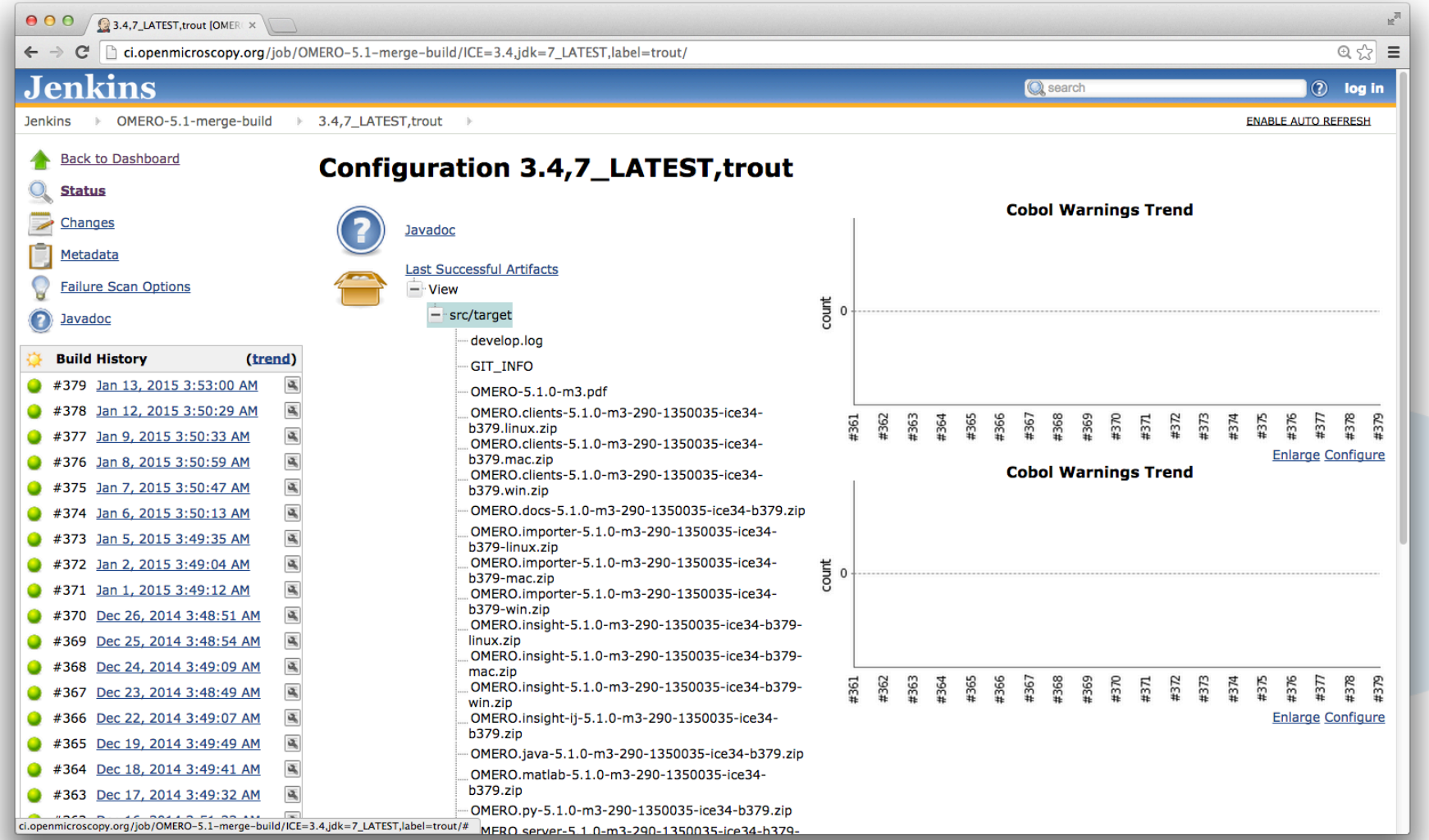
- Build JARs

  ```
  $ ant jars
  ```

- Build Javadoc

  ```
  $ ant docs-sphinx
  ```

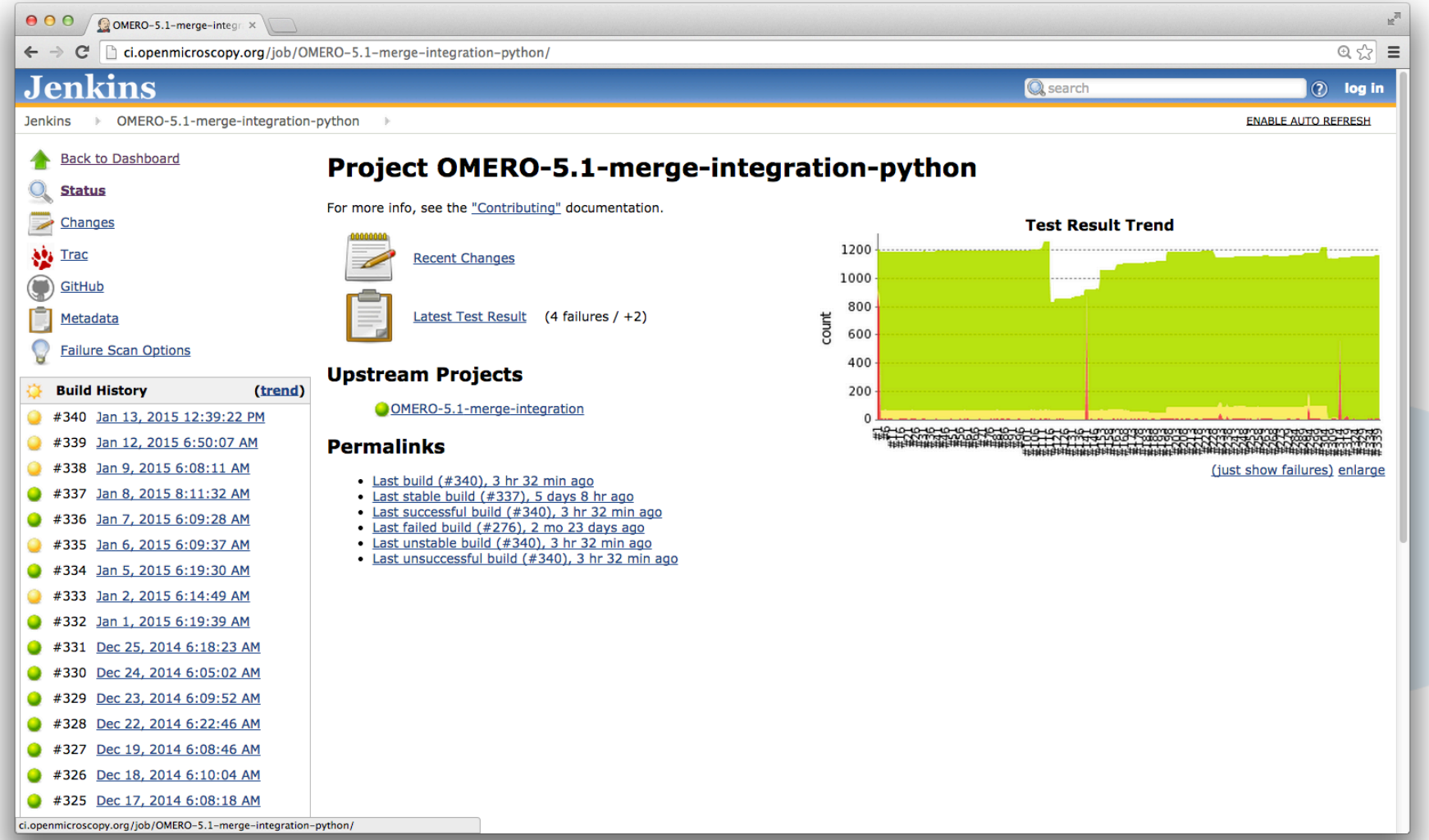
Build artifacts



Test

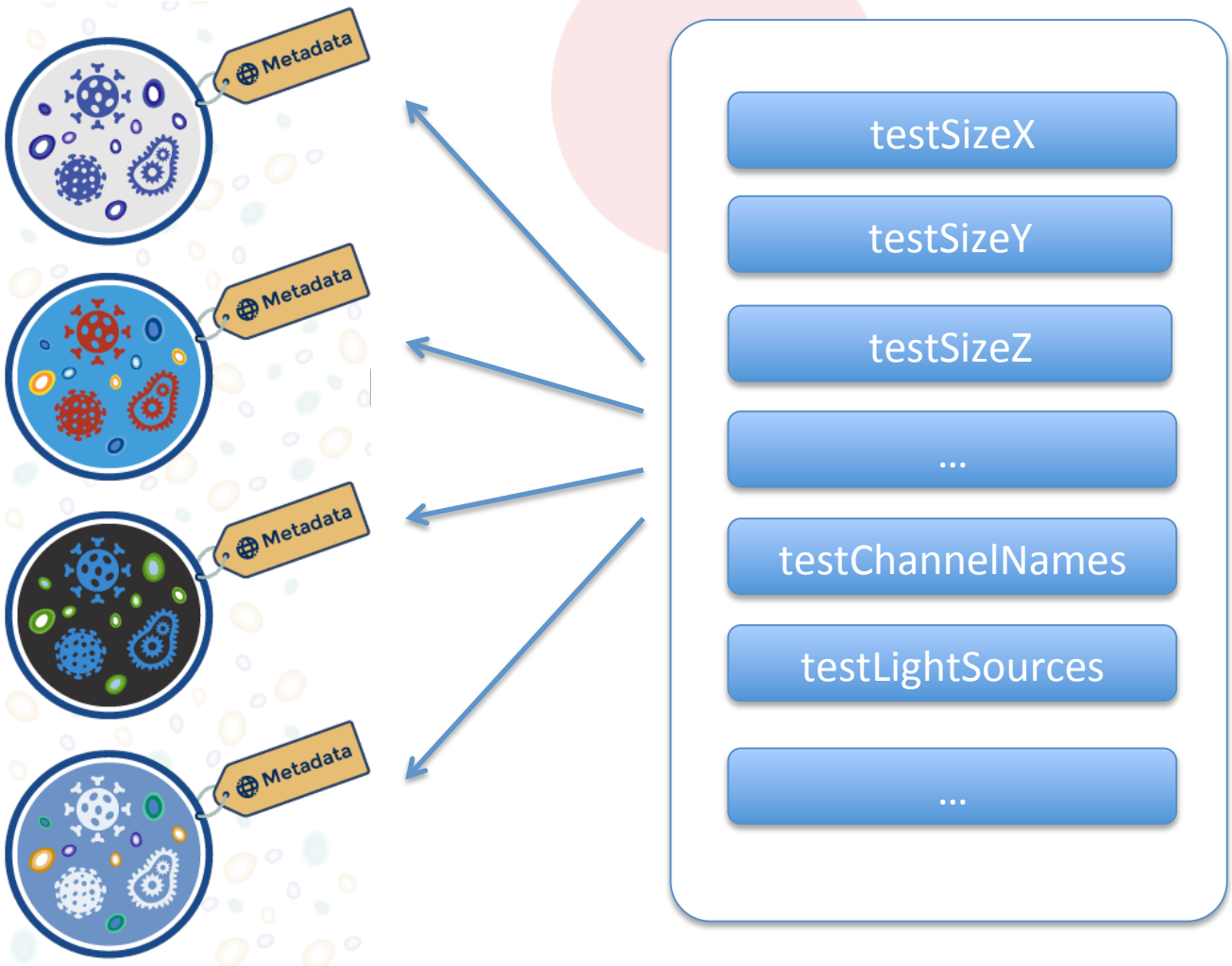
- Manual QA testing for each code submission
- Automated testing
  - OMERO server, OMERO clients, Bio-Formats
  - Unit/integration tests
- Testing framework: TestNG, Robot framework, pytest…
- Example:
  - addition of a new method to the API
  - addition of corresponding integration tests testing the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

OMERO server integration tests

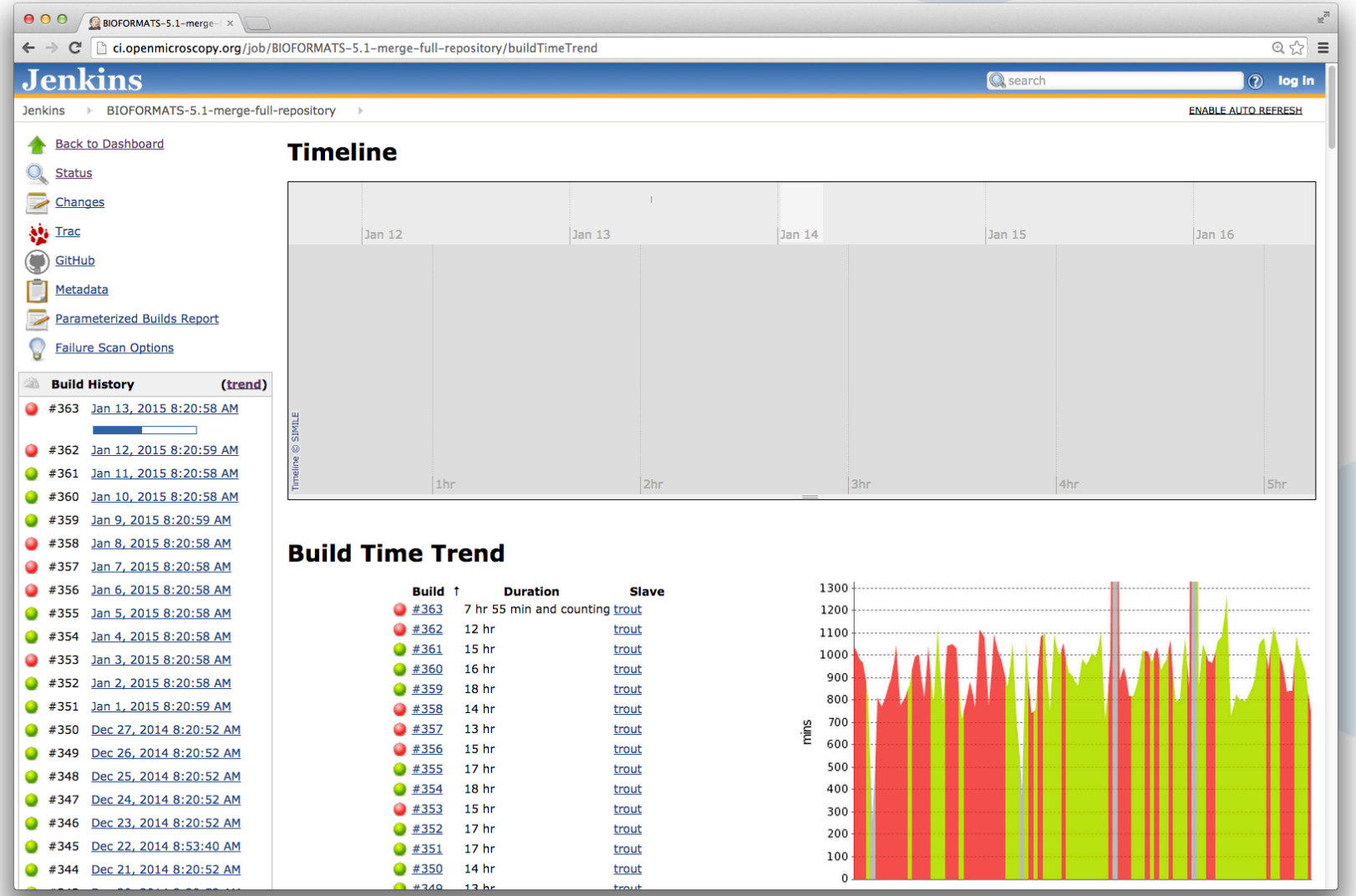


Bio-Formats automated tests

Large repository of samples files for each supported format

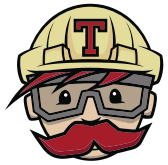


Bio-Formats automated tests (II)

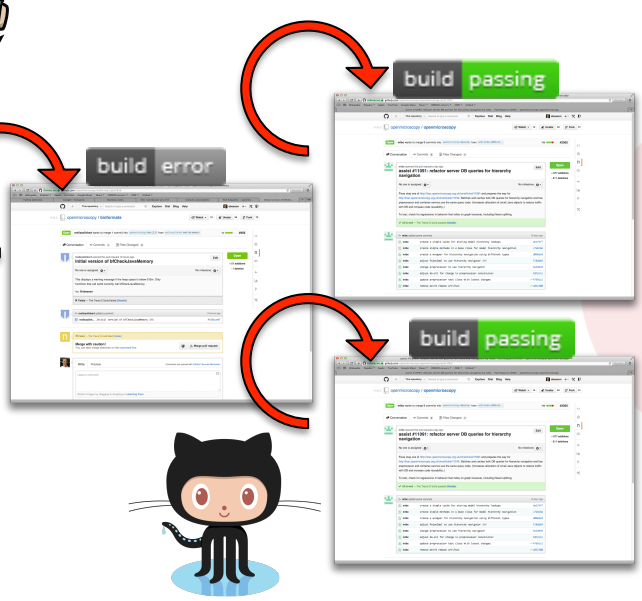


12K files (1.8 TB), 300K tests, 12096m/12 threads

OME CI: Daily workflow



Travis CI



Jenkins

Merge

Build

Deploy

Test

OME

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

wellcome trust

bbsrc
biotechnology and biological sciences research council

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

Robot framework
http://robotframework.org/

- Build

Ant
http://ant.apache.org/

Maven
http://maven.apache.org/

Cmake
http://www.cmake.org/

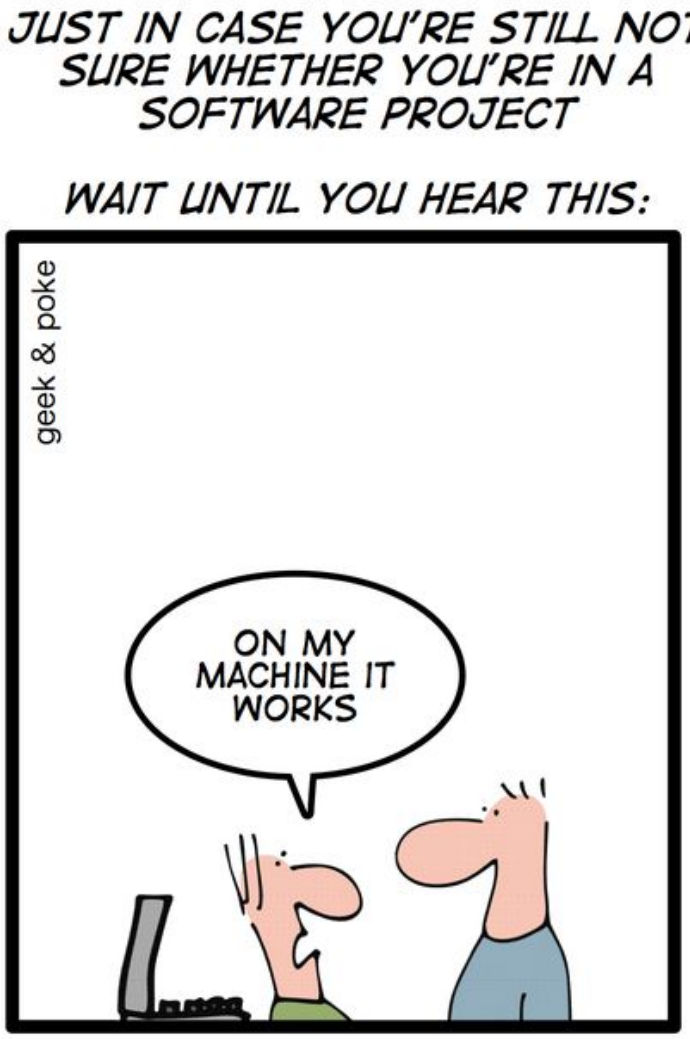
- Continuous Integration/Deployment

Travis CI
http://travis-ci.org/
https://travis-ci.org/openmicroscopy/

Jenkins CI
http://jenkins-ci.org/
http://ci.openmicroscopy.org

Docker
https://www.docker.com/

Continuous integration server



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