Continuous Integration

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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

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:

YESTERDAY IT WORKED

YOU KNOW YOU’RE IN A SOFTWARE PROJECT

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
**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

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**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

GitHub interface showing a pull request titled "assist #11091: refactor server DB queries for hierarchy navigation" by mtbc. The pull request includes a description, a conversation thread, and a list of commits. The pull request has been opened and is awaiting review.
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

OMERO

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

BIO-FORMATS

- 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

testSizeX

testSizeY

testSizeZ

... 

testChannelNames

testLightSources

...
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
Resources

○ Source Control
  - Git
  - GitHub
    - [https://github.com/](https://github.com/)
    - [https://github.com/openmicroscopy](https://github.com/openmicroscopy)

○ Testing
  - Pytest
    - [http://pytest.org/latest/](http://pytest.org/latest/)
  - TestNG
  - Robot framework
    - [http://robotframework.org/](http://robotframework.org/)

○ Build
  - Ant
  - Maven
  - Cmake

○ Continuous Integration/Deployment
  - Travis CI
    - [https://travis-ci.org/openmicroscopy](https://travis-ci.org/openmicroscopy)
  - Jenkins CI
    - [http://ci.openmicroscopy.org](http://ci.openmicroscopy.org)
  - Docker
    - [https://www.docker.com/](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:

ON MY MACHINE IT WORKS
## Source code: changes frequency

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<th>OMERÖ</th>
<th>Bio-Formats</th>
<th>Documentation</th>
<th>Scripts</th>
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Changes on dev_5_0 branch between 25 Sept 2012 and 20 Jan 2014