



Science For A Better Life



Catching Up: Continuous Integration Pipelines For Clinical Analysis

PhUSE 2017

October 2017 / Andrew Karpow

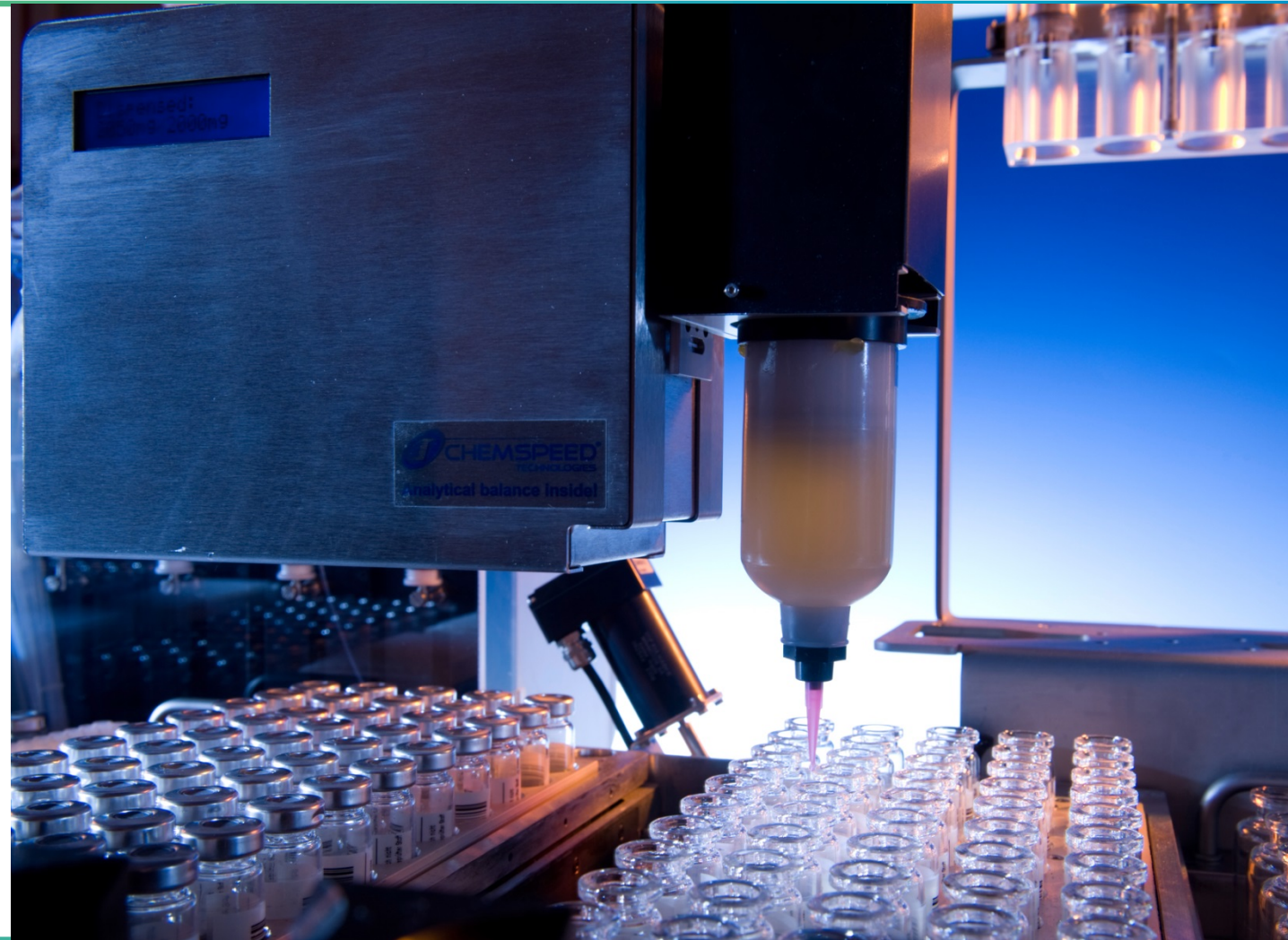


Agenda

- What's continuous integration?
- Jenkins CI
- Jenkins Pipelines
- Jenkins SAS® Plugin
- Possible improvements

What's continuous integration?

- fully automated way of doing
 - Unit tests
 - Code quality analyzation
 - Ensuring error free execution
 - Post build processing
 - Report generation
 - Job scheduling



Jenkins CI

“The leading open source automation server, Jenkins provides hundreds of plugins to support building, deploying and automating any project.”

- Open Source and free
- Self hosted software
- Extensible with java plugins
- Fully customizable build pipeline
- But no general SAS® support (yet)
 - Though there exists a SASUnit Plugin*

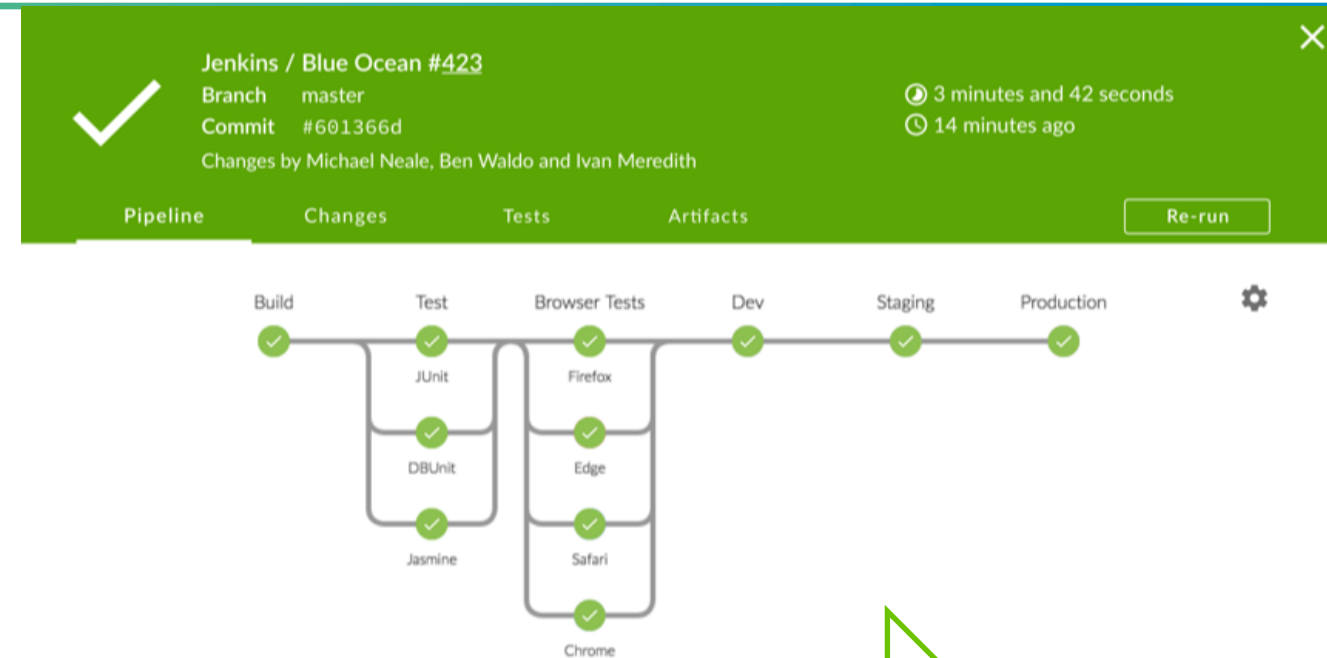
* HMS Analytical Software GmbH, "GitHub Jenkins Plugin for SASUnit," 07 2017. [Online]. Available:

<https://github.com/jenkinsci/sasunit-plugin>.



Jenkins CI

- Code can be fetched from a variety of repository systems (SVN / GIT / FTP / WEB / shared folders)
- Process pipeline is easily adjustable via web UI
- Ability to preserve and archive generated artifacts
- Results can be published and post processed by external applications
- Parallel execution of build steps possible with Pipeline Plugin (e.g. parallel run with SAS® 9.2, 9.3 and 9.4)



Checkout

- fetch SAS® programs

Build

- execute SAS® jobs
- execute unit tests

Process

- process result listings
- process unit test results

Post-Process

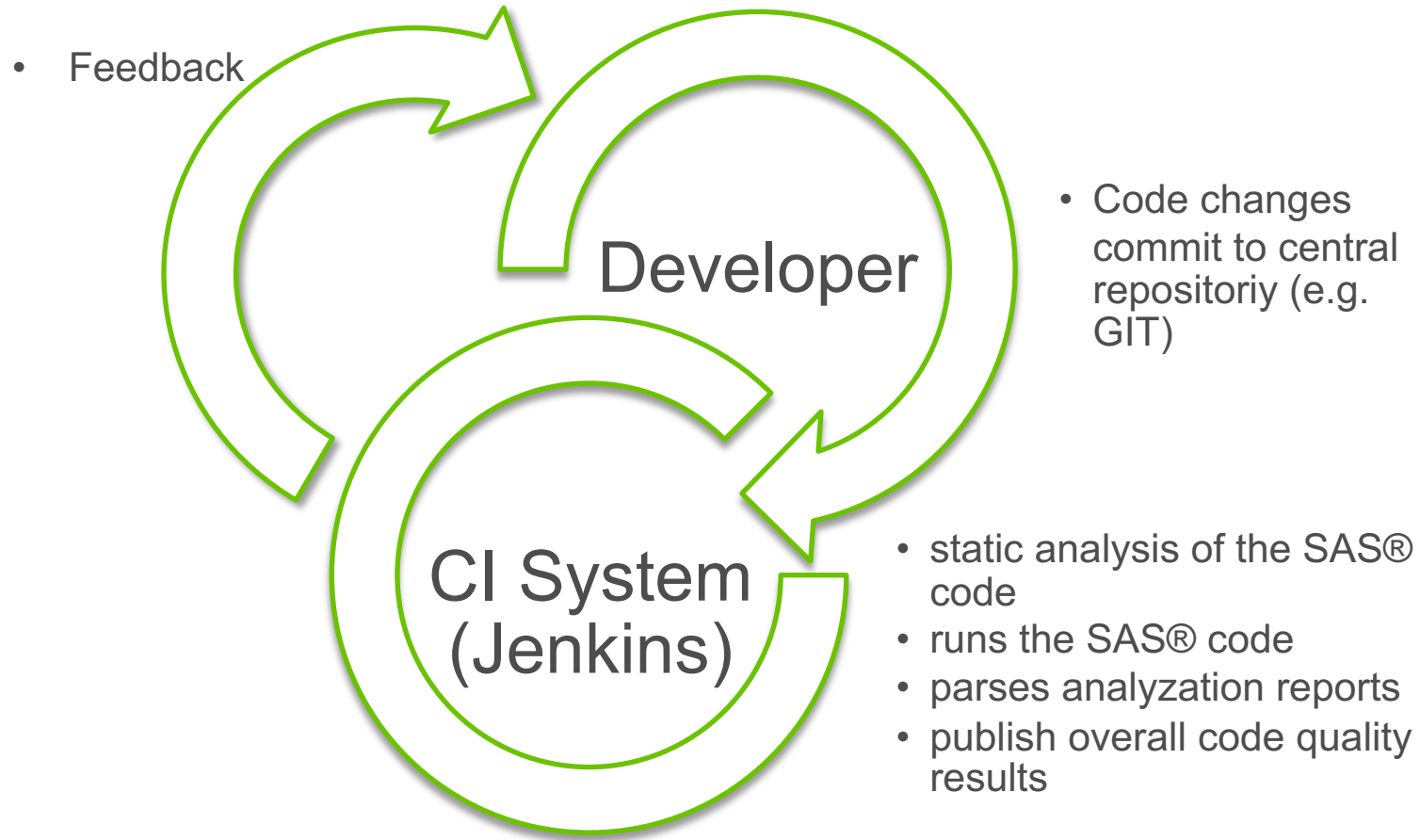
- Release process
- notifications
- Start productive batch



Jenkins SAS® Plugin

SAS® job executor and report analyzer

Jenkins SAS® Plugin



Jenkins SAS® Plugin

- Adds a new buildstep (execute SAS®)
- Automatically invokes the SAS® interpreter, global configuration available
- Evaluates the output and return code of a SAS® Run and sets the Jenkins build status accordingly
- Provides report generation with help of the SCAPROC procedure
- Evaluates return code of SAS® unit tests

```
Started by user Testuser1
Building in workspace /var/run/Jenkins/workspace
Running SAS Jenkins Plugin
NOTE: Copyright (c) 2002-2008 by SAS Institute Inc., Cary, NC, USA.
...
NOTE: SAS initialization used:
real time 0.00 seconds
cpu time 0.00 seconds
1 proc print data=sashelp.air;
2 run;
NOTE: There were 144 observations read from the data set SASHELP.AIR.
NOTE: The PROCEDURE PRINT printed pages 1-3.
NOTE: PROCEDURE PRINT used (Total process time):
real time 0.01 seconds
cpu time 0.02 seconds
SAS statistics of SAS Run #26 published successfully!
Finished: SUCCESS
```

Report analyzer



 **Jenkins**

Jenkins > SASTest > #26 > SAS Result of Build #26

[ENABLE AUTO REFRESH](#)

View SAS Statistics of build #26

procname DATASTEP

Elapsed: 116

```
data a;  
  input x y z @@; cards;  
  1 2 3 4 5 6 7 8 9  
run;
```

accessed datasets

Name	Direction ↑	Access
WORK.A.DATA	OUTPUT	SEQ

accessed symbols

Name	Access
SYS_IHOUSEEE	GET

used libnames

Libname ↑
WORK V9 '/opt/sas/SAS_WORK

procname SUMMARY

Elapsed: 122

```
proc summary data=a;  
  var x;  
  output out=new1 mean=mx;  
run;
```

accessed datasets

Name	Direction	Access
WORK.A.DATA	INPUT	MULTI
WORK.NEW1.DATA	OUTPUT	SEQ

accessed symbols

Name	Access
SYS_IHOUSEEE	GET
SYSSUMTRACE	GET
SQLMAGIC	GET

used libnames

Libname
WORK V9 '/opt/SAS-El/sas92/saswork/SAS_work0DCF00008DA6_by-swandev.de.bayer.cnib/SAS_workF85300008DA6_by-swandev.de.bayer.cnib'
WORK V9 '/opt/SAS-El/sas92/saswork/SAS_work0DCF00008DA6_by-swandev.de.bayer.cnib/SAS_workF85300008DA6_by-swandev.de.bayer.cnib'

procname SUMMARY

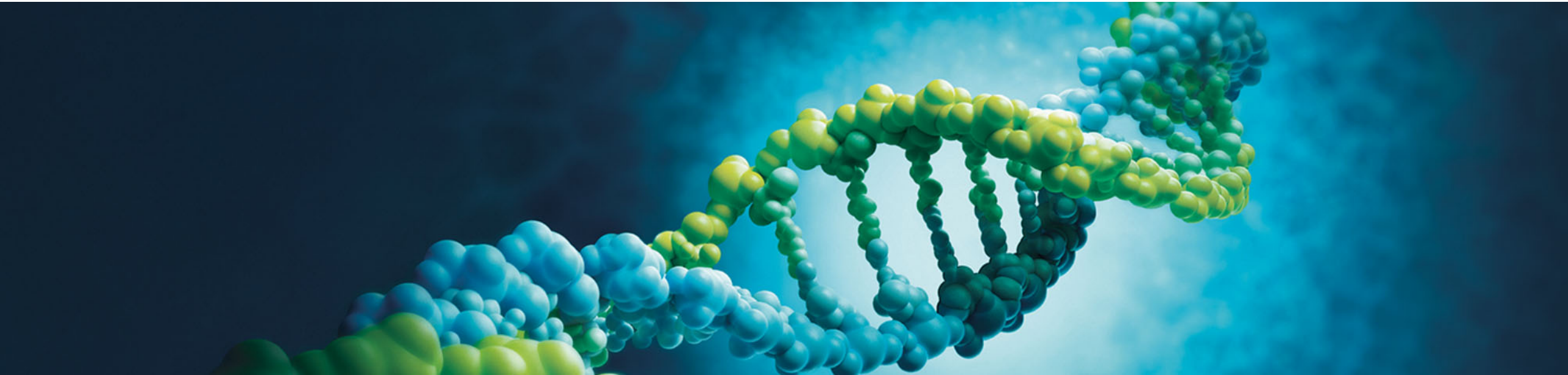
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Possible improvements

- Tightly integrate SAS® via Java-API with Jenkins CI
- Schedule SAS® Cluster jobs on several Jenkins nodes
- Static code analysis of SAS® code
- Checkstyle integration of SAS® code for evaluation of code style with Jenkins CI
- Integration of a generic unit test framework for SAS® programs
- Continuous deployment for recurring SAS® jobs



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Thank you!

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