

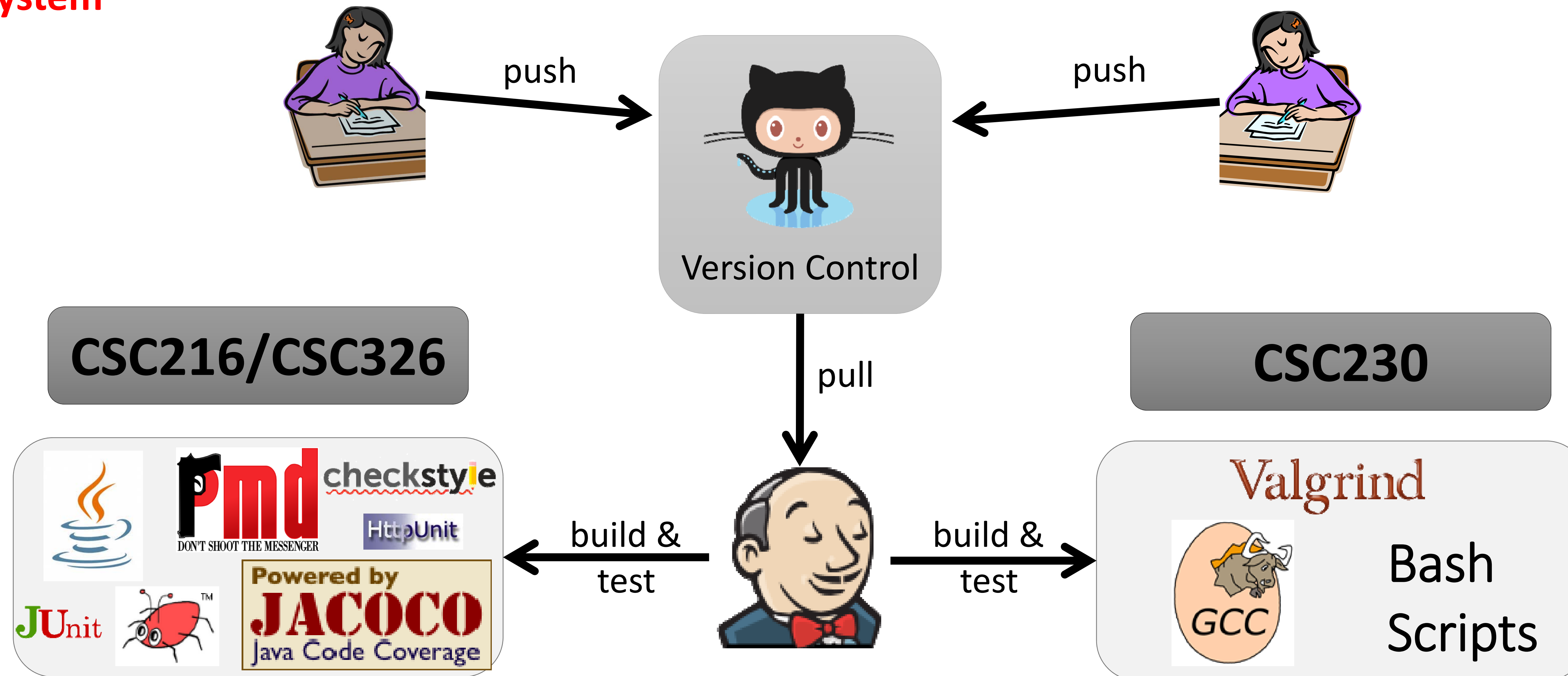
# Automating Software Engineering Best Practices Using an Open Source Continuous Integration Framework

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## Overview

**Goal:** to *improve* software engineering courses by *incorporating* best practices for automated software engineering and *facilitating* rapid feedback for students using an open source continuous integration framework for evaluating student software development

## System



### Build History

#	Time	Size
#6	Mar 1, 2015 3:40 PM	152 KB
#5	Mar 1, 2015 3:38 PM	158 KB
#4	Mar 1, 2015 3:36 PM	163 KB
#3	Mar 1, 2015 3:34 PM	2.4 KB
#2	Mar 1, 2015 3:28 PM	2.4 KB
#1	Mar 1, 2015 3:28 PM	2.4 KB

```

15:28:17 build_student:
15:28:17 [echo] Building Student Project...
15:28:17 [javac] /var/lib/jenkins/Summer2014/jobs/TT_sesmith5/workspace/CashRegister_MASTER/build
to build.sysclasspath:last set to false for repeatable builds
15:28:17 [javac] Compiling 7 source files to /var/lib/jenkins/Summer2014/jobs/TT_sesmith5/work
15:28:19 [javac] /var/lib/jenkins/Summer2014/jobs/TT_sesmith5/workspace/CashRegister_MASTER/src
error: cannot find symbol
15:28:19 [javac]     currency[0] = new Currency(PENNY_VALUE, PENNY_NAME, initialCount);
15:28:19 [javac]           ^
    
```

### Build #3 (Mar 1, 2015 3:34:06 PM)

Changes: 1 Fixed compiler error, but failing tests and static analysis (commit)

Started by an SCM change

Revision: 1174302eb2ee13cd79591ac20996f4e3d9d6bb

Checkstyle: 2 warnings from one analysis

FindBugs: 7 warnings from one analysis

PMD: 1 warning from one analysis

Test Result: (0 failures / +20)

### Build #6 (Mar 1, 2015 3:40:11 PM)

Changes: 1 Should have everything fixed! (commit)

Started by an SCM change

Revision: 55c754eb3e6021c3e37f30d2c1b8bd257c3620

Checkstyle: 0 warnings from one analysis

FindBugs: 0 warnings from one analysis

PMD: 0 warnings from one analysis

Test Result: (no failures)

### Regression

edu.ncsu.csc216.cash\_register.CashRegisterTest.testProcessRefund

Falling for the past 1 build (Since @#3)

```

Stacktrace
java.lang.NullPointerException
    at edu.ncsu.csc216.cash_register.CurrencyCollection.<init>
(CurrencyCollection.java:66)
    at edu.ncsu.csc216.cash_register.CashRegister.<init>
(CashRegister.java:29)
    at
    
```

### Overall Coverage Summary

name	instruction	branch	complexity	line	method	class
all classes	26%	30%	24%	30%	37%	33%
M: 29 C: 106	M: 31 C: 13	M: 31 C: 10	M: 65 C: 28	M: 12 C: 7	M: 2 C: 1	

### Overall Coverage Summary

name	instruction	branch	complexity	line	method	class
all classes	95%	75%	76%	91%	100%	100%
M: 21 C: 308	M: 11 C: 33	M: 10 C: 31	M: 8 C: 86	M: 0 C: 19	M: 0 C: 3	

### Build History

#	Time
#3	Feb 22, 2015 3:02 PM
#2	Feb 22, 2015 3:01 PM
#1	Feb 22, 2015 2:28 PM

```

+ make rem
gcc -g -Wl -Wl -std=c99 -c -o reminder.o reminder.c
gcc reminder.o -o reminder
./test.sh
rm -f reminder
rm -f reminder.o
rm -f test/actual*
rm -f test/file_output
gcc -g -Wall -std=c99 -c -o reminder.o reminder.c
gcc reminder.o -o reminder
Test test0 PASS
Test test1 PASS
Test test2 PASS
Test test3 PASS
Test test4 PASS
Test test5 PASS
Test test6 PASS
Test test7 PASS
Test test8 PASS
Test test9 PASS
Test test10 PASS
Test test11 PASS
+ echo
+ echo
./val_file_test.sh
rm -f reminder
rm -f reminder.o
rm -f test/actual*
rm -f test/file_output
gcc -g -Wall -std=c99 -c -o reminder.o reminder.c
gcc reminder.o -o reminder
test0 NO FILE LEAK
test1 NO FILE LEAK
test2 NO FILE LEAK
    
```

## Software Engineering Best Practices

Best Practice	CSC216 / CSC326	CSC230
Continuous Integration		
Version Control		
Language		
Unit Testing	JUnit	Custom Framework
Code Coverage	Powered by JACOCO Java Code Coverage	gcc gcov
Acceptance Testing	HttpUnit (CSC326 Only)	File Redirection / Diff
Static Analysis	checkstyle, PMD	Custom Scripts
Security		Valgrind

## Survey Results

Course	CSC216	CSC230	CSC326
Semester	Sum. 2014	Sum. 2014	Fall 2013
# Student Responses	13	14	56
Increase Productivity	85%	93%	76%
Increase Quality	92%	93%	84%
Use Future Projects	85%	71%	80%
Recommend	85%	86%	67%

## Future Work

- Additional surveys of student learning, efficacy, engagement, and enjoyment
- Use system (and generated data) in larger study of software engineering skill transfer
- Additional tooling as appropriate for courses

## Acknowledgements

- Mr. Barry Peddycord, III (CSC230)
- Mr. Christopher Theisen
- Virtual Computing Lab (VCL)
- CSC IT Staff
- Other CSC216/CSC230/CSC326 instructors