TEACHING  USING THE GitHub ECOSYSTEM

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UseR! 2015 - Aalborg

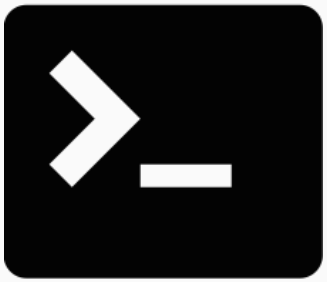
Duke University
Department of Statistical Science

STA 523 - STATISTICAL PROGRAMMING

Course details:

- First offered in Fall 2014
- Core course in Masters of Statistical Science Program
- Approximately 30 Students
  - 2/3 MSS & MSEM, 1/3 other MS & PhD
  - Divided into teams of 3-4
  - Disparate backgrounds
- Biweekly team programming assignments
- Team final project, individual final exam

TECHNICAL LEARNING OBJECTIVES



METHODOLOGICAL LEARNING OBJECTIVES

Collaboration

Reproducible Research

- R Markdown / knitr
- GNU Make

Data in the Real World

- Messy data
- Non-flat data

INFRASTRUCTURE

Dedicated departmental server

- RStudio Server Pro
- Individual departmental accounts
- System wide install of core packages

Github Organization

- 1 private repo / team (Github Education)
- Shared public repos (e.g. examples)

Continuous Integration

- TravisCI, Wercker, Drone, etc.

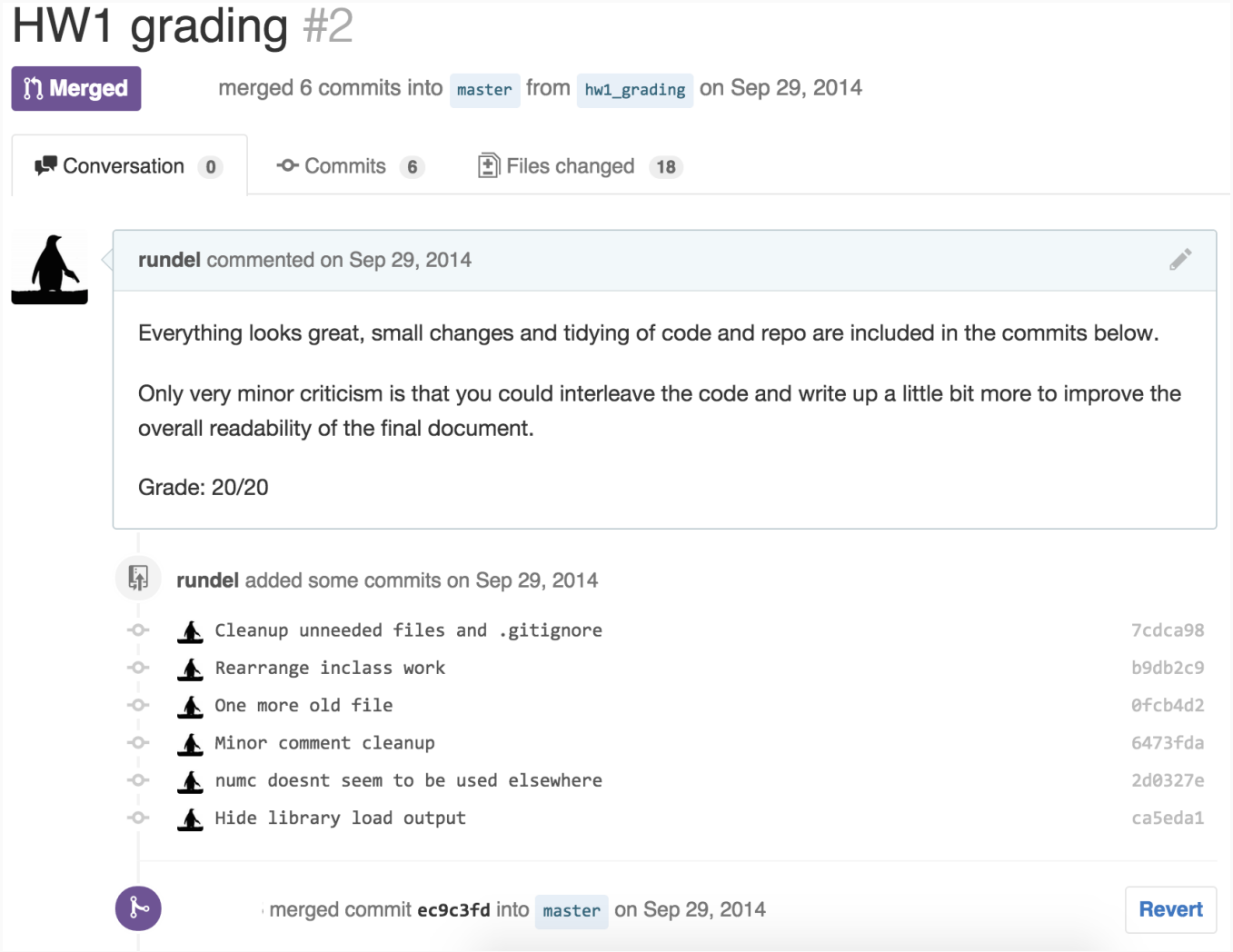
ASSIGNMENTS

All assignments are turned in via github (pull the repo at the deadline)

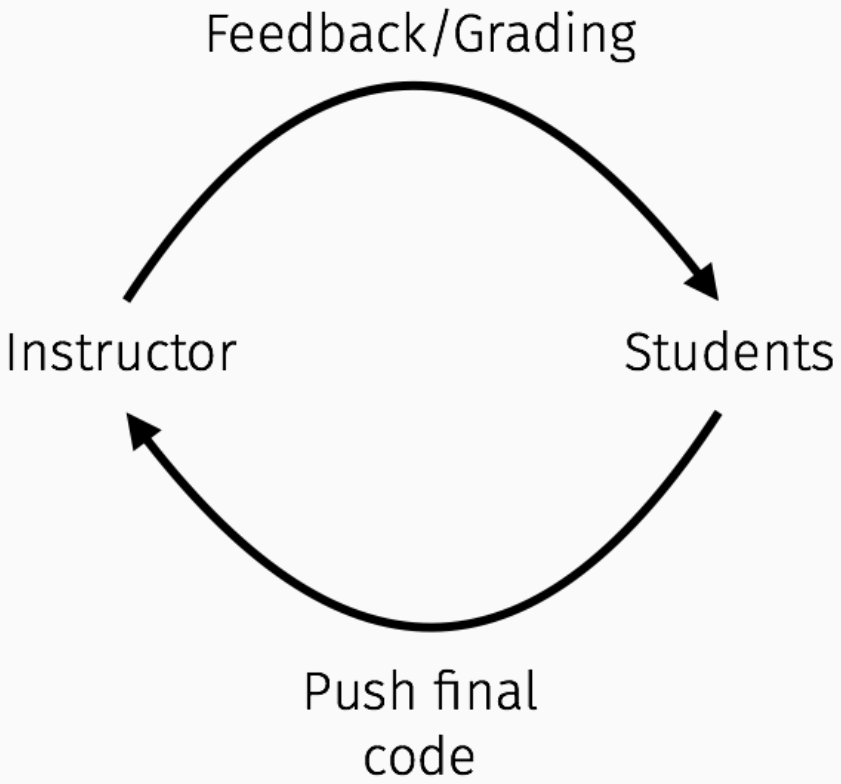
What do we get from this?

- Forces students to use version control
- Simplifies course administration
  - Code / documentation / scaffolding all in the same place
  - Easy to grab files (pull)
  - Easy to distribute files (push)
- Searchability
- Accountability

Grading and feedback is given via pull requests



COURSE PROCESS CARTOON



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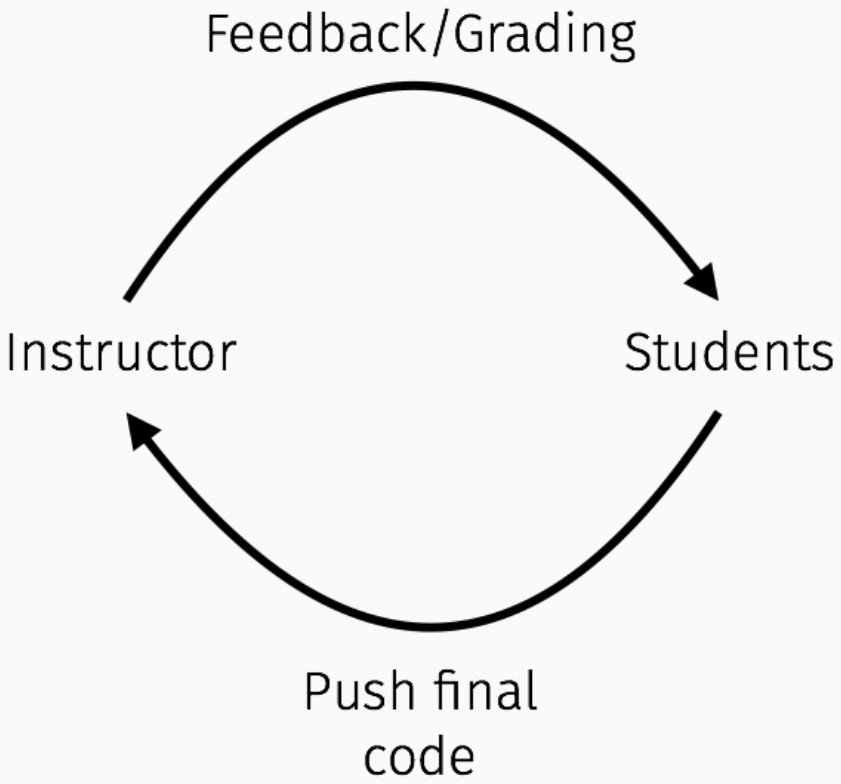

Github does improve both parts of this cycle

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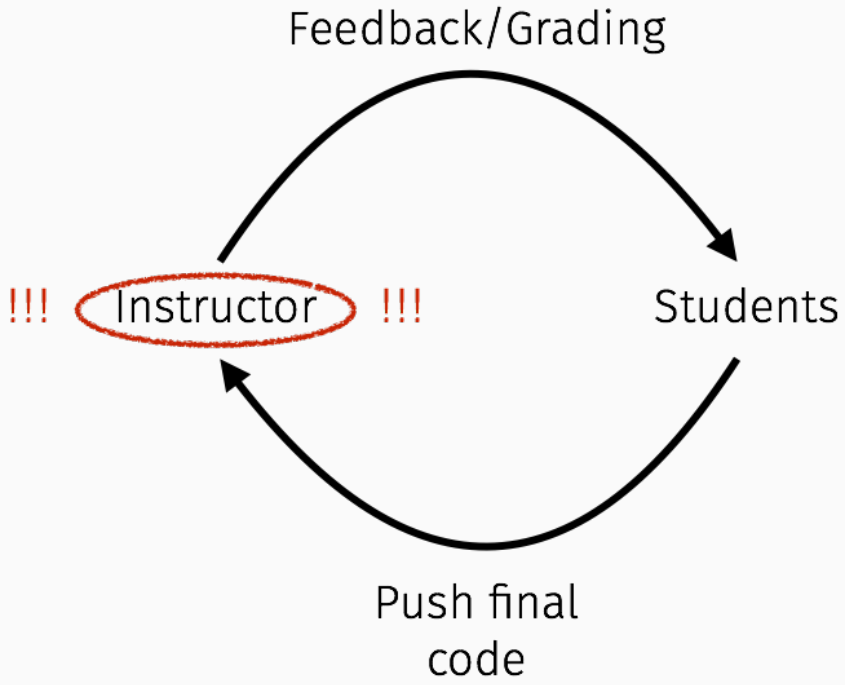

Github does improve both parts of this cycle but doesn't address the fact that *the instructor / TAs are the rate limiting step* (we don't scale well).

A PAINFULLY COMMON CONVERSATION

Student: We've submitted our HW3!

+1 Day

Me: Your Rmd file doesn't knit, you used `setwd` *with an absolute path.*

+1 Day

Student: Ok we fixed that, does it work now?

+1 Day

Me: Nope, you used `lme4` *without checking if it was installed.*

+1 Day

⋮

A SOLUTION?

In the limited universe of this class,

$$\text{Me} = \text{CRAN}$$

$$\text{Student} = \text{Package Developer}$$

so what we want is some variant of `R CMD check`.

CHECK FEATURES

What should our `R CMD check` look like?

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Ideally it should check that . . .

- the code runs, Rmds knit
- the coding style is consistent
- the repo is tidy
- the code runs in a reasonable time frame
- the implementations are correct

AUTOMATION

We would also like this to be done automatically.

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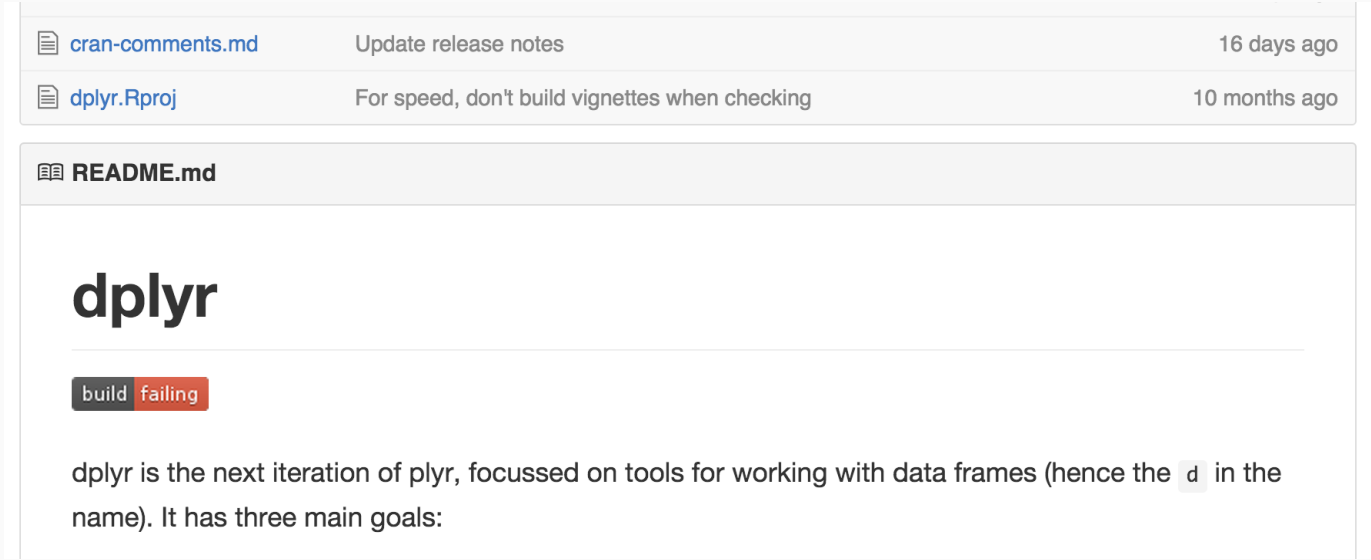
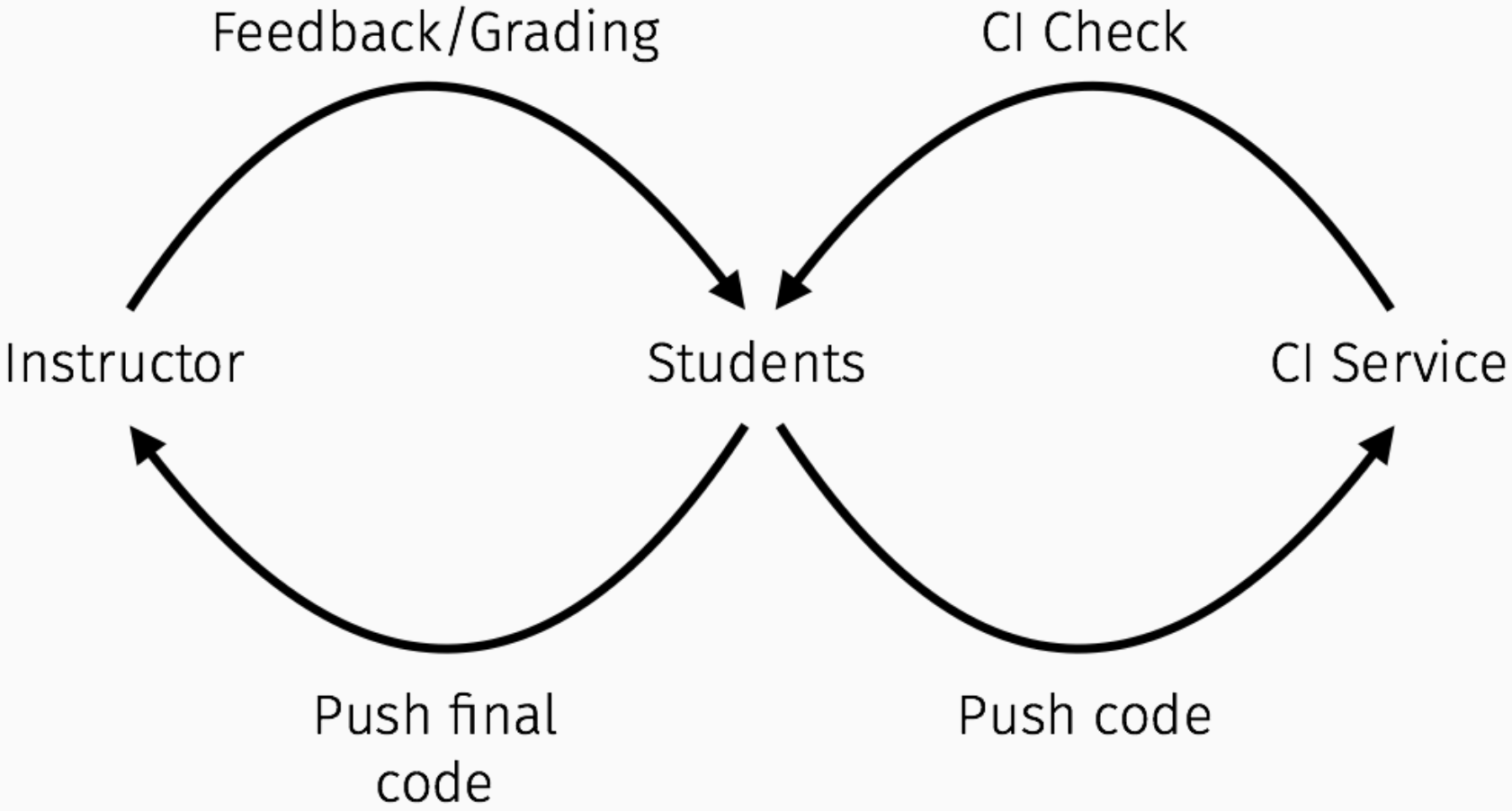
Again we can take a lesson from the package developers.



COURSE PROCESS CARTOON - IMPROVED



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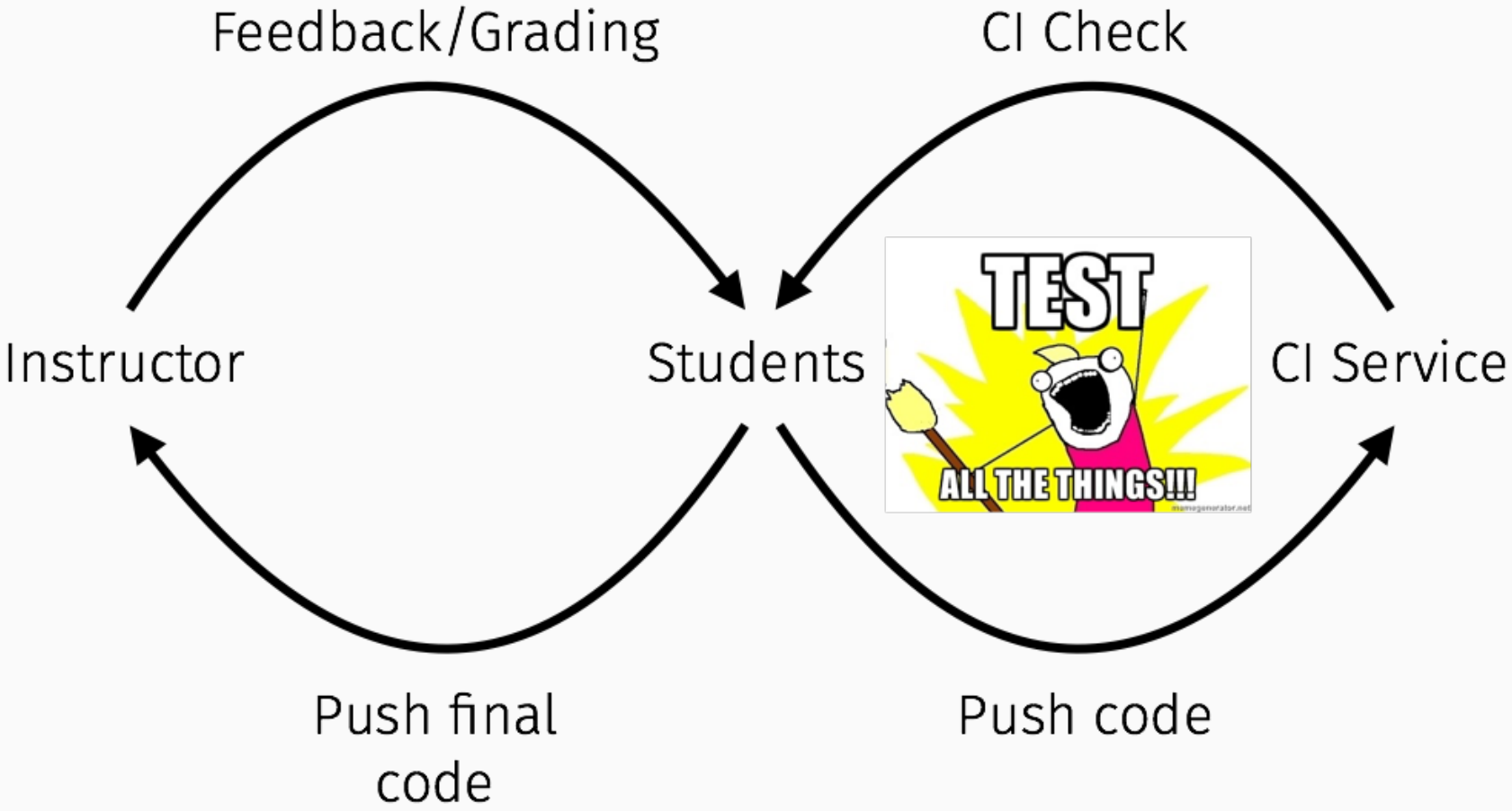

IMPLEMENTATION

This is currently more aspirational than reality, but the following is planned for the coming Fall 2015 semester.

Key details (subject to change):

- Adopting wercker for CI (uses Docker, steps)
- Enforced coding style via `lintr`
- Enforced directory structure
- Allowed file/filetype whitelist
- `testthat` for testing implementation assignments
- automated scoring of prediction contests

CONCLUSIONS

Using github gives you a lot (for free) . . .

- Version control
- Accessible web UI
- Education support
- Collaboration tools
- Search tools
- CI tools

Needs of an R programming class are very similar to the needs of the R development community

- No need to reinvent the wheel - use the existing solutions
- Teach the tools students will continue to use

QUESTIONS, COMMENTS?

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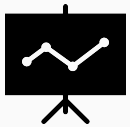
github.com/rundel/



github.com/rundel/Presentations/

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