



LGTM Meow

**“Looks Good to Me”**

**By a software engineer that probably doesn't want to do code review,  
or a quick stamp of approval after a thorough code review**

# Code Review

What? Why? How?

Apollo Zhu, CSE 403 23SP

**A constructive review of a fellow developer's code.**

**A required sign-off from another team member before a developer is permitted to check in changes or new code.**

**Code Review**

# Why Code Review

## Didn't we already have tests?

- Average defect detection rates
  - Unit testing: 25%
  - Integration testing: 45%
  - Design and code inspections: 55% and 60%
- 11 programs developed by the same group of people
  - No reviews: average 4.5 errors per 100 LOC
  - With reviews: average 0.82 errors per 100 LOC

# Why Code Review

## Didn't we already have tests?

- No reviews: average 4.5 errors per 100 LOC
- With reviews: average 0.82 errors per 100 LOC
- IBM's Orbit project
  - 500,000 LOC, 11 levels of inspections
  - Delivered early with 1% of the predicted errors
- After AT&T introduced reviews
  - 14% increase in productivity and a 90% decrease in defects

**“All code that gets submitted needs to be reviewed by at least one other person, and either the code writer or the reviewer needs to have readability in that language. Most people use Mondrian [now Critique] to do code reviews, and obviously, we spend a good chunk of our time reviewing code.”**

**Amanda Camp, Software Engineer, Google**





Think different.



# “What could go wrong?”

Famous last words

### Commit changes

Commit message

Quick fix

Extended description

Trust me bro, it works on my machine

Commit directly to the main branch

Create a new branch for this commit and start a pull request  
[Learn more about pull requests](#)

Cancel Commit changes

Cancel Commit changes

# Branch Protection

## Branch name pattern \*

main

## Protect matching branches

### Require a pull request before merging

When enabled, all commits must be made to a non-protected branch and submitted via a pull request before they can be merged into a branch that matches this rule.

### Require approvals

When enabled, pull requests targeting a matching branch require a number of approvals and no changes requested before they can be merged.

Required number of approvals before merging: 1 ▾

### Do not allow bypassing the above settings

The above settings will apply to administrators and custom roles with the "bypass branch protections" permission.

## Rules applied to everyone including administrators

### Allow force pushes

Permit force pushes for all users with push access.

### Allow deletions

Allow users with push access to delete matching branches.

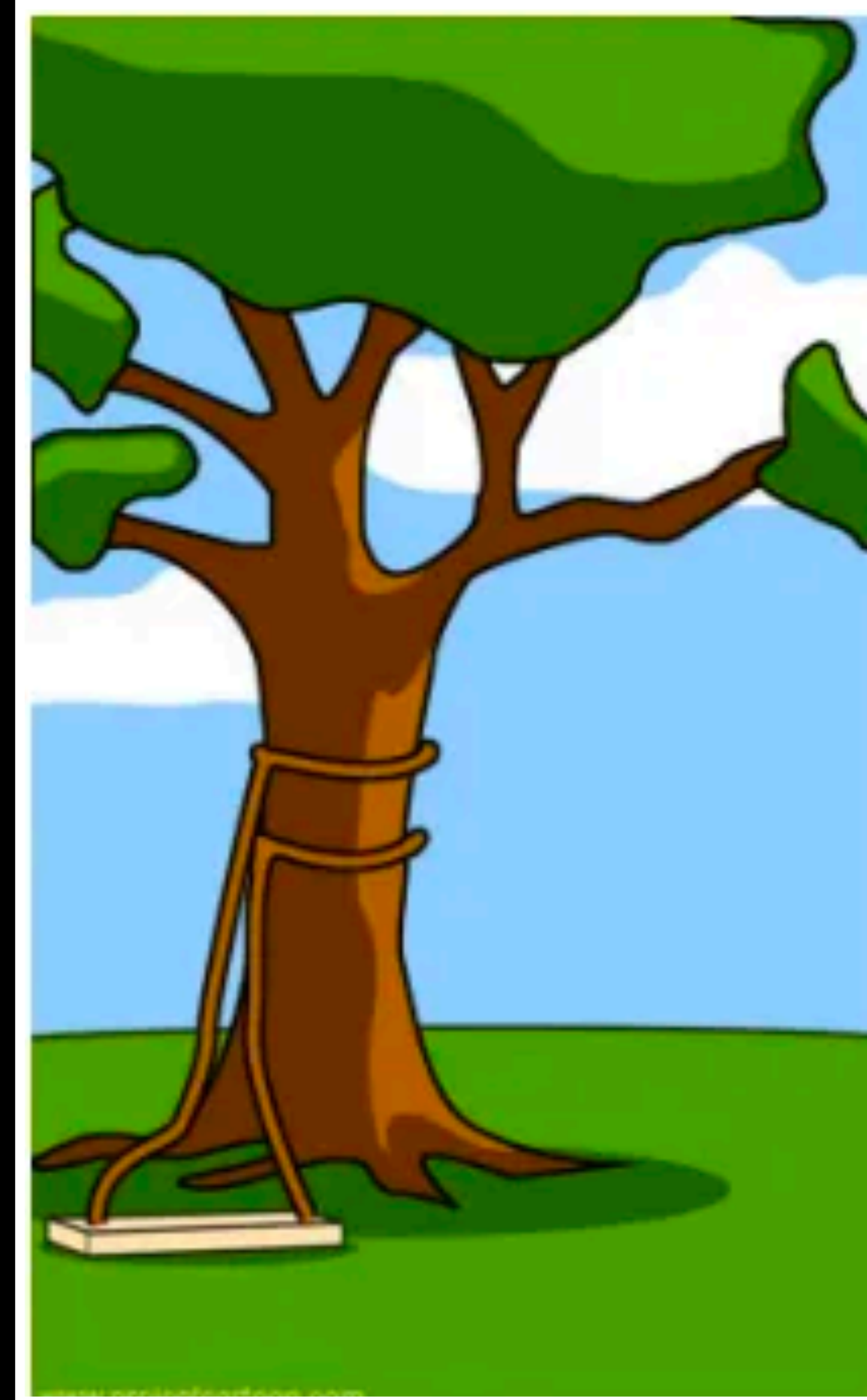
# New Workflow - Happy Path

- New Branch
- Commit, Push, (Repeat)
- Open Pull Request
- Code Review



- Merge







**How the programmer  
wrote it**




# How the programmer wrote it

Finish your review

Write Preview

H B I  $\equiv$   $\langle \rangle$      @  

Can do better

Attach files by dragging & dropping, selecting or pasting them. 

**Comment**  
Submit general feedback without explicit approval.

**Approve**  
Submit feedback approving these changes.

**Request changes**  
Submit feedback suggesting changes.

Submit review

"At Facebook, we have an internally-developed web-based tool to aid the code review process. Once an engineer has prepared a change, she submits it to this tool, which will notify the person or people she has asked to review the change, along with others that may be interested in the change -- such as people who have worked on a function that got changed.

At this point, the reviewers can make comments, ask questions, request changes, or accept the changes. **If changes are requested, the submitter must submit a new version of the change to be reviewed.** All versions submitted are retained, so reviewers can compare the change to the original, or just changes from the last version they reviewed. Once a change has been submitted, the engineer can merge her change into the main source tree for deployment to the site during the next weekly push, or earlier if the change warrants quicker release."

**Ryan McElroy, Software Engineer, Meta**

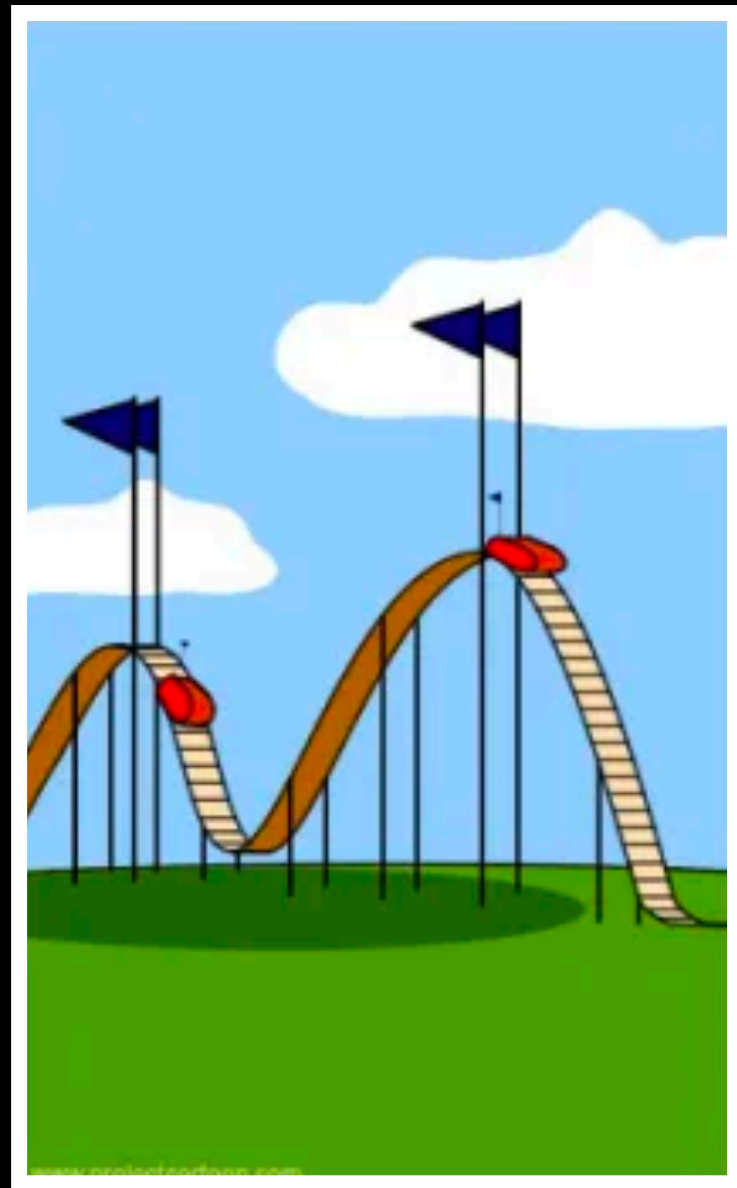


# What are we reviewing?

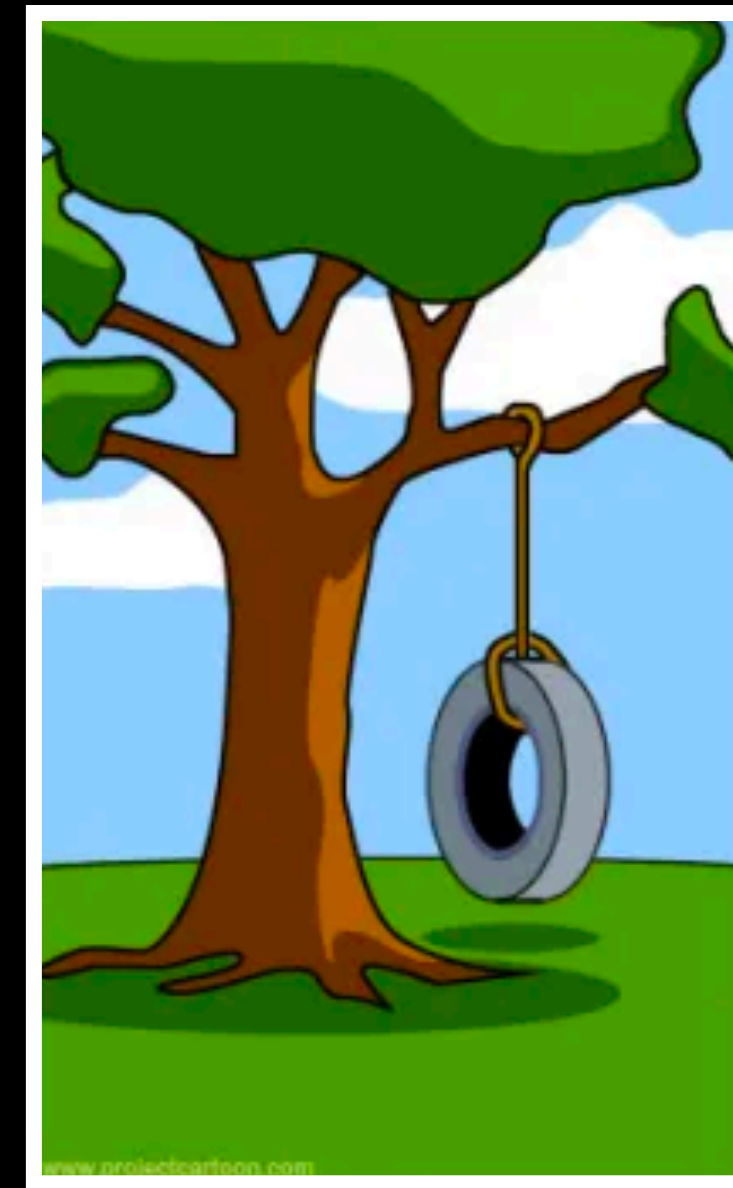
- Verification: are we building the system right?
- Validation: are we building the right system?

# What are we reviewing?

- Verification: are we building the system right?
- Validation: are we building the right system?



What the PR included

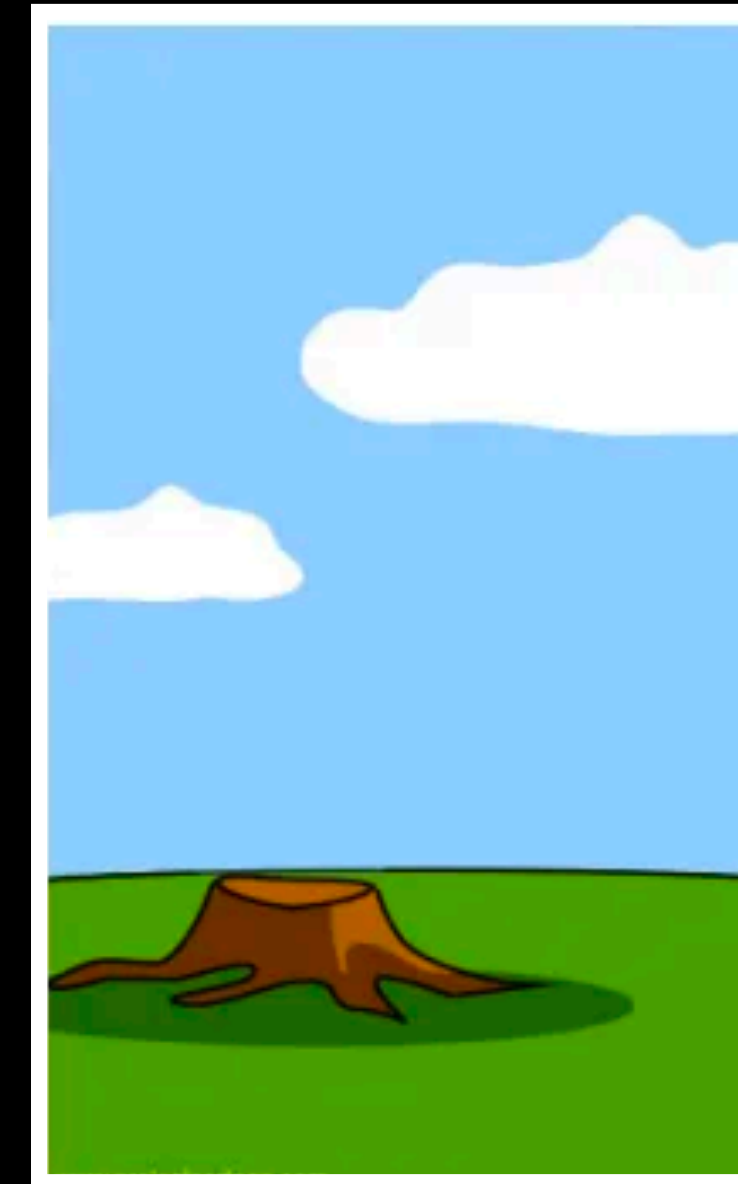


What the customer really needed

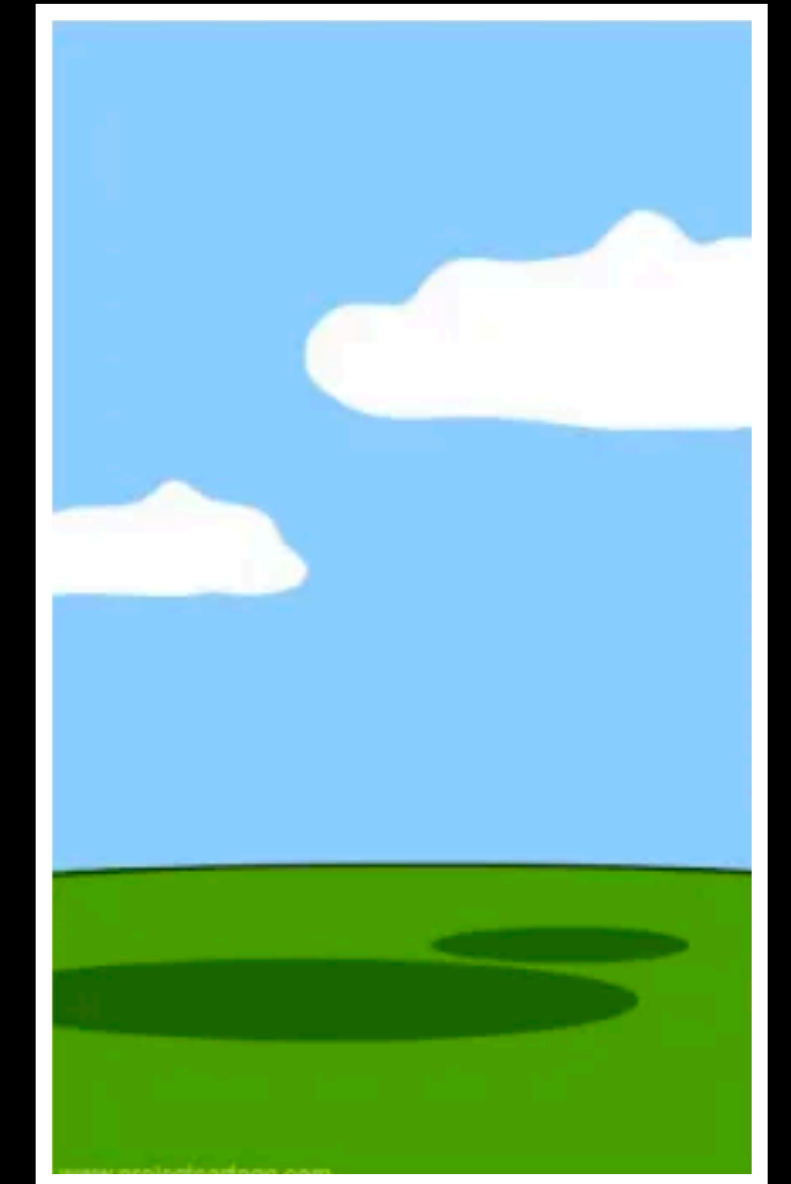


# What are we reviewing?

- Verification: are we building the system right?
- Validation: are we building the right system?
- Presence of good properties?
- Absence of bad properties?
- Identifying errors?
- Confidence in the absence of errors?



How much the tests covered



How the code was documented

# What are we reviewing?

- Verification: are we building the system right?
- Validation: are we building the right system?
  
- Presence of good properties?
- Absence of bad properties?
  
- Identifying errors?
- Confidence in the absence of errors?
  
- Robust? Safe? Secure? Available? Reliable?
- Understandable? Modifiable?
- Cost-effective?
- Usable?

```

public class Account {
    double principal, rate; int daysActive, accountType;
    public static final int STANDARD = 0, BUDGET = 1,
        PREMIUM = 2, PREMIUM_PLUS = 3;

    public static double calculateFee(Account[] accounts)
    {
        double totalFee = 0.0;
        Account account;
        for (int i=0; i<accounts.length; i++) {
            account=accounts[i];
            if (account.accountType == Account.PREMIUM ||
                account.accountType == Account.PREMIUM_PLUS)
                totalFee += .0125 * ( // 1.25% broker's fee
                    account.principal * Math.pow(account.rate,
                        (account.daysActive / 365.25))
                    - account.principal); // interest-principal
        }
        return totalFee;
    }
}

```

**Code Review Exercise**

“At Yelp we use review-board. An engineer works on a branch and commits the code to their own branch. The reviewer then goes through the diff, adds inline comments on review board and sends them back. *The reviews are meant to be a dialogue*, so typically comment threads result from the feedback. Once the reviewer's questions and concerns are all addressed they'll click "Ship It!" and the author will merge it with the main branch for deployment the same day.”

Alan Fineberg, Software Engineer, Yelp



# Example Dialogue

<https://github.com/apple/swift/pull/34094>

## Implement canImport test for submodule #34094

Merged CodaFI merged 1 commit into `apple:main` from `ApolloZhu:fix-canImport-submodule` on Jan 4

Conversation 31 Commits 1 Checks 0 Files changed 24

AZ

ApolloZhu commented on Sep 26, 2020 · edited · Collaborator

This PR extends `canImport` to check for submodule availability.

Forums Thread: <https://forums.swift.org/t/41196>

### Motivation

Currently, `canImport` only supports checking for top-level module availability while many have submodules with different availability. For example, while `CIFilter` was introduced in iOS 5, `CIFilterBuiltins` is only available on iOS 13+. Therefore, one might want to write code like this:

```
#if canImport(CoreImage.CIFilterBuiltins)
  ^ Unexpected platform condition argument: expected identifier

import CoreImage.CIFilterBuiltins
...
#endif
```

### Changes needed for *The Swift Programming Language Reference*

This PR would mean:

```
+ module-name → import-path
- module-name → identifier
```

For housekeeping, because `import OpenGL.(GL3, GL3.Ext)` is (likely) never implemented, unless we're planning to have a separate PR extending import to support operators (e.g. `import func SomeModule.+++`) as mentioned in [#34094 \(comment\)](#), we should update:

```
+ import-path → identifier | identifier . import-path
- import-path → import-path-identifier | import-path-identifier . import-path
- import-path-identifier → identifier | operator
```

### Alternatives Considered

While the initial concern could be addressed by introducing `#if available` similar to how `@available/#available` works but at the top level, clang modules may specify other requirements, therefore allowing `canImport` to check for submodule availability directly should be a more well-rounded and direct approach.

### Questions/Concerns

# Example Dialogue

Correctness

Efficiency

Alternatives

Documentation Changes

User Testing and Feedback

A screenshot of a GitHub discussion thread showing five comments. The comments are from users ApolloZhu (AZ), amartini51, and CodaFI (cf). The thread includes a link to a forum proposal, a code snippet, and a request for a rebase. The comments are dated from October 14, 2020, to June 10, 2021.

**AZ** (Collaborator, Author) commented on Oct 14, 2020  
Will ask in the forum. Thanks for all the suggestions

**AZ** (Collaborator, Author) commented on Oct 14, 2020  
<https://forums.swift.org/t/proposal-or-bug-fix-allow-canimport-to-check-for-submodule-availability/41196>

**amartini51** (Contributor) commented on Oct 14, 2020  
Thanks for calling out the impact on the reference and grammar of "The Swift Programming Language". I'll follow this PR so I can update the documentation as needed.  
  
The grammar allows operators in an import is probably for the form that allows you to specify a specific declaration to import. (Git history shows me that grammar rule dates back to the original Swift 1 version of the book.) For example, something like `import func SomeModule.+++` would import only the function that implements the `+++` operator from `SomeModule`. However, that form of import doesn't appear to actually work, and I'm unsure whether it was ever actually part of the language's implementation.  
  
❤️ 1

**AZ** (Collaborator, Author) commented on Nov 13, 2020  
So far the community response agrees this is a simple bug fix and no further changes need to be made. What shall we do next?

**AZ** (Collaborator, Author) commented on Feb 5, 2021 • edited  
I know the community is busy discussing new concurrency proposals, but should I submit/pitch a simple Swift Evolution proposal for this change as well?

**cf** (Member) commented on Jun 10, 2021  
@ApolloZhu  
Please rebase this when you can and tag me here and we'll get this merged.  
  
❤️ 2

# Making a Good Pull Request

## Think like a reviewer

- Use descriptive but concise title and summary
- Describe context, rationale, and alternatives considered
- Link to relevant resources (specs, issues/bug tracker, previous PR)
- Provide screenshots/recordings for UI changes
- <https://github.blog/2015-01-21-how-to-write-the-perfect-pull-request/>

# Logistics - CSE 403

## How and where?

- Online/electronic
- In-person meeting
  - Best to prepare beforehand: artifact is distributed in advance
  - Preparation is critical and usually identifies more defects than the meeting

## Who participates?

- One other developer
- A group of developers

## What is reviewed?

- A specification
- A coherent module (e.g., checklist-style “inspection”)
- An entire component (“holistic review”)
- A single code commit or PR (“incremental review”)



**“Can someone review this PR please?  
Thanks”**

**A message that you'll likely see in Slack**

**YES**

**WHO?**

**WHEN?**

# Logistics

- Who should review what changes?
- How to set up (automated) notifications?
- How many reviewers per change?
- What's the expected review time frame?
- Approval for requested changes vs. general feedback
- Who submits after approval?
  - LGTM and "auto-submit" -> reviewer submits
  - Approval plus comments -> author submits

**“We tried doing code reviews, but it was not useful. We never find any bugs or errors; the code is always approved.”**

**A counter argument**

# Logstics

- How to establish an effective and inclusive peer-review process?
- How to minimize biases in the peer-review process?

# Action Items

- Figure out code review logistics with the team
- Start using pull requests and doing code reviews
- Enforce code review through branch protection
- Automate the code review process with CI checks

