Best Practices for CI in Python

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Acknowledgement of Country

Belmont (in San Francisco Bay Area Peninsula)
Ancestral homeland of the Ramaytush Ohlone people

Continuous Integration: The Talk: The Steps

- What makes continuous integration

Continuous Integration: The Talk: The Steps

- ► What makes continuous integration
- ► What makes continuous integration good

- ▶ What makes continuous integration
- ▶ What makes continuous integration good
- ▶ How to make your continuous integration good

What makes continuous integration?

The gears in the machine

(Usual) Requirements for Continuous Integration

Local "build":

(Usual) Requirements for Continuous Integration

Local "build":
Lint

(Usual) Requirements for Continuous Integration

Local "build":
Lint
Test

(Usual) Requirements for Continuous Integration

Local "build":
Lint
Test
Package

Continuous Integration: Run Build on Server

When?

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When?
Classic: Nightly

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Modern: Merge to main

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Advanced: Suggested patch (Pull Request, Merge Request)

Continuous Integration: Run Build on Server

When?
Classic: Nightly
Modern: Merge to main
Advanced: Suggested patch (Pull Request, Merge Request)
Exotica (Merge trains and more)

Continuous Integration: Patch Builds

Focus of talk

Focus of talk
Automated gate: "is patch good?"

Continuous Integration: Runners

Architecture:

- ▶ CI coordinator
- ▶ CI runners

Continuous Integration: Build logs

Modern frameworks:

Continuous Integration: Build logs

Modern frameworks:
Collect live from runners

Continuous Integration: Build logs

Modern frameworks:
Collect live from runners
Retain "forever"

What makes continuous integration good?

Paint the target

CI criteria: accuracy

Is the answer correct?

CI criteria: actionability

If patch is not good, how clear is it how to fix?

CI criteria: actionability

If patch is not good, how clear is it how to fix?
How to reproduce locally?

CI criteria: promptness

How long does it take to answer?

CI criteria: cost

Mostly the runner compute cost

How to improve your CI

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Improve accuracy

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Improve accuracy
Improve actionability

How to improve your CI

Improve accuracy
Improve actionability
Improve promptness

How to improve your CI

Improve accuracy
Improve actionability
Improve promptness
Improve cost

CI accuracy: use containers

Container images with:

CI accuracy: use containers

Container images with:
Version of Python

CI accuracy: use containers

Container images with:
Version of Python
Other non-Python dependencies

CI accuracy: use containers

Container images with:
Version of Python
Other non-Python dependencies
Pin the image tag!

CI accuracy: pin versions

Test against pinned dependencies

CI accuracy: pin versions

Test against pinned dependencies
Upgrade pins in a dedicated patch

CI accuracy: pin versions

Test against pinned dependencies
Upgrade pins in a dedicated patch
(There are services)

CI accuracy: test quality

Monitor and improve test quality

CI accuracy: test quality

Monitor and improve test quality
(This is a whole 'nother talk)

CI actionability: set verbosity to 11

Use verbosity options in test runners/linters/etc.

CI actionability: set verbosity to 11

Use verbosity options in test runners/linters/etc.
Logs can be filtered more easily than unfiltered

CI actionability: test failure verbosity

Test assertion failure in test for verbosity

CI actionability: test failure verbosity

Test assertion failure in test for verbosity
When raising exception, add details!

CI actionability: environmental details

Spew details on environment to logs

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Environment variables

CI actionability: environmental details

Spew details on environment to logs
Environment variables
Platform

CI actionability: environmental details

Spew details on environment to logs
Environment variables
Platform
Etc.

CI actionability: environmental details

Spew details on environment to logs
Environment variables
Platform
Etc.
(Don't put secrets in environment)

CI promptness: caching

Use CI primitives to cache downloads

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Container layer caching

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Container layer caching(complicated but worth it)

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Use CI primitives to cache downloads
Container layer caching(complicated but worth it)
Local PyPI and Container caching proxies

CI promptness: pooling

Reuse connections, downloads, etc.

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Reuse connections, downloads, etc.
Think carefully how to break up tests

CI promptness: fail fast

Order tests based on likelihood to fail

CI promptness: fail fast

Order tests based on likelihood to fail

Open source solutions exist

CI promptness: parallelize runs

Use CI primitives to parallelize independent runs

CI promptness: parallelize tests

Use tester primitives to parallelize independent runs

CI promptness: mock slowness

Mock out slow things

CI cost: kill useless runs

Example: Commit added to patch

CI cost: stop runs early

Do you need to finish if it fails?

CI cost: stop runs early

Do you need to finish if it fails?
(Sometimes! Trade-offs)

CI cost: better tests

Examples: Better stubbing/mocking instead of real services

CI quality: trade-offs

Accuracy

CI quality: trade-offs

Accuracy
Actionability

CI quality: trade-offs

Accuracy
Actionability
Promptness

CI quality: trade-offs

Accuracy
Actionability
Promptness
Cost

CI quality: trade-offs

Accuracy
Actionability
Promptness
Cost
Effort!

CI quality: trade-offs

Accuracy
Actionability
Promptness
Cost
Effort!
Decide!

CI quality: measure

Given trade-offs, is this ok?

CI quality: improve

What needs to be better?

CI quality: repeat

Keep your eye on the ball!