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

What is Continuous Integration made of?

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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Classic: Nightly

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Advanced: Suggested patch (Pull Request, Merge Request)

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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

Continuous Integration: Patch Builds

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 CI 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

CI accuracy: use containers

Container images with:

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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

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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.

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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

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Environment variables
Platform

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Spew details on environment to logs
Environment variables
Platform
Etc.

CI actionability: environmental details

Spew details on environment to logs
Environment variables
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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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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

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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

Effort

CI quality: trade-offs

Effort
Quality

CI quality: trade-offs

Effort
Quality
Cost

CI quality: trade-offs

Effort
Quality
Cost
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!