Comprehensive testing strategies for modern microservice architectures

About me 👋

- DevRel since 2021
- Go Engineer since 2018
- LinkedIn Learning instructor
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What percentage of time do you think developers spend fixing bugs?

A) <25%

Less than a quarter of our time

B) 25-50%

Between a quarter and half our time

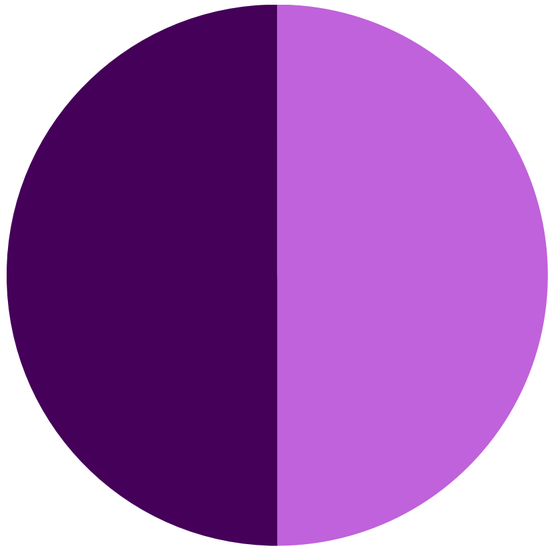
C) >50%

The majority of our time

Developers spend 25-50% of their time fixing bugs.

B) 25-50%

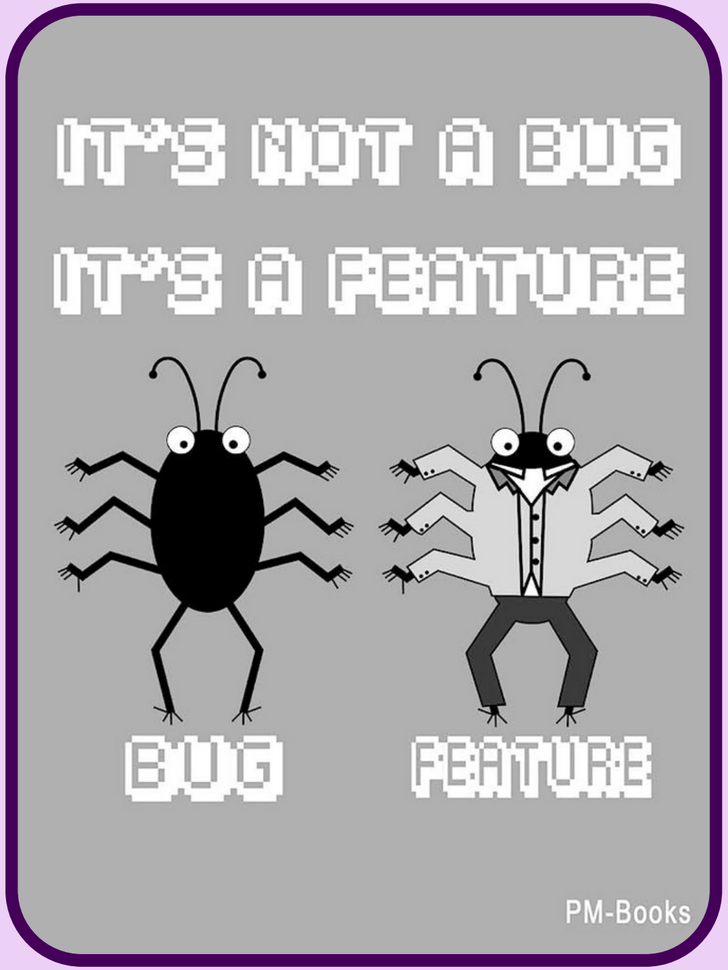
Between a quarter and half our time



(Source: Rollbar survey)

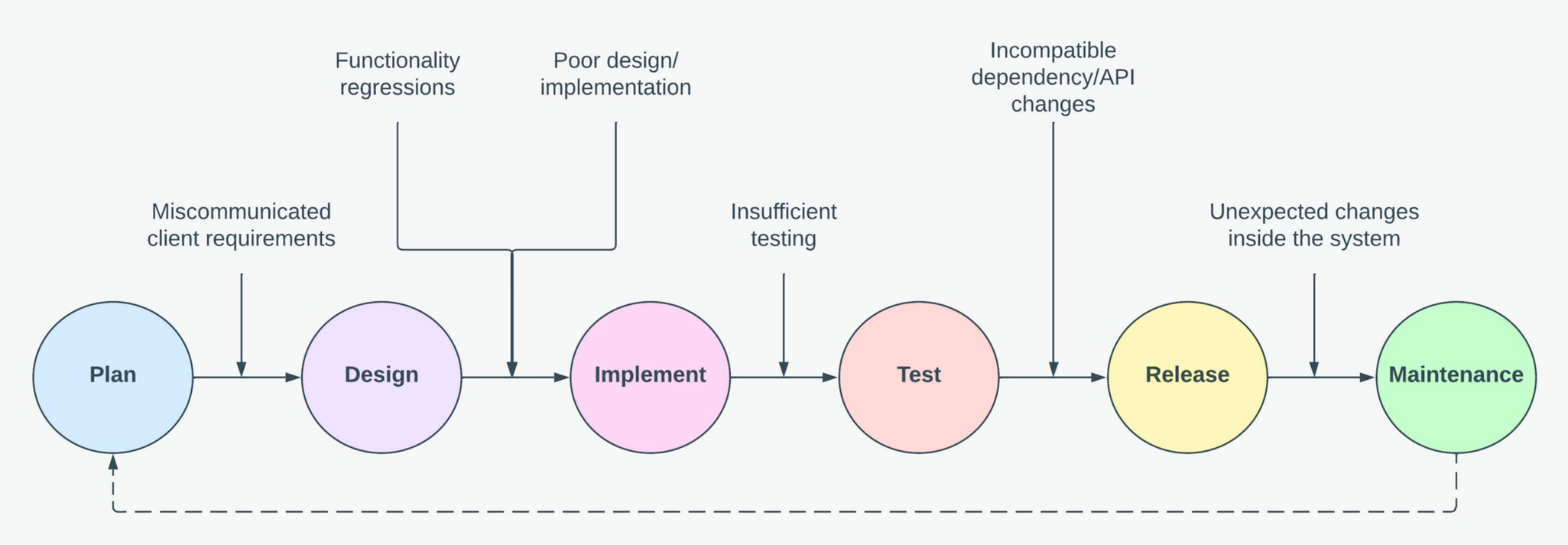
🦠 Common bug causes

- Miscommunicated client requirements
- Poor design/implementation
- Insufficient testing
- Functionality regressions
- Incompatible dependency/API changes
- Unexpected changes inside the system



Creator: PM Books

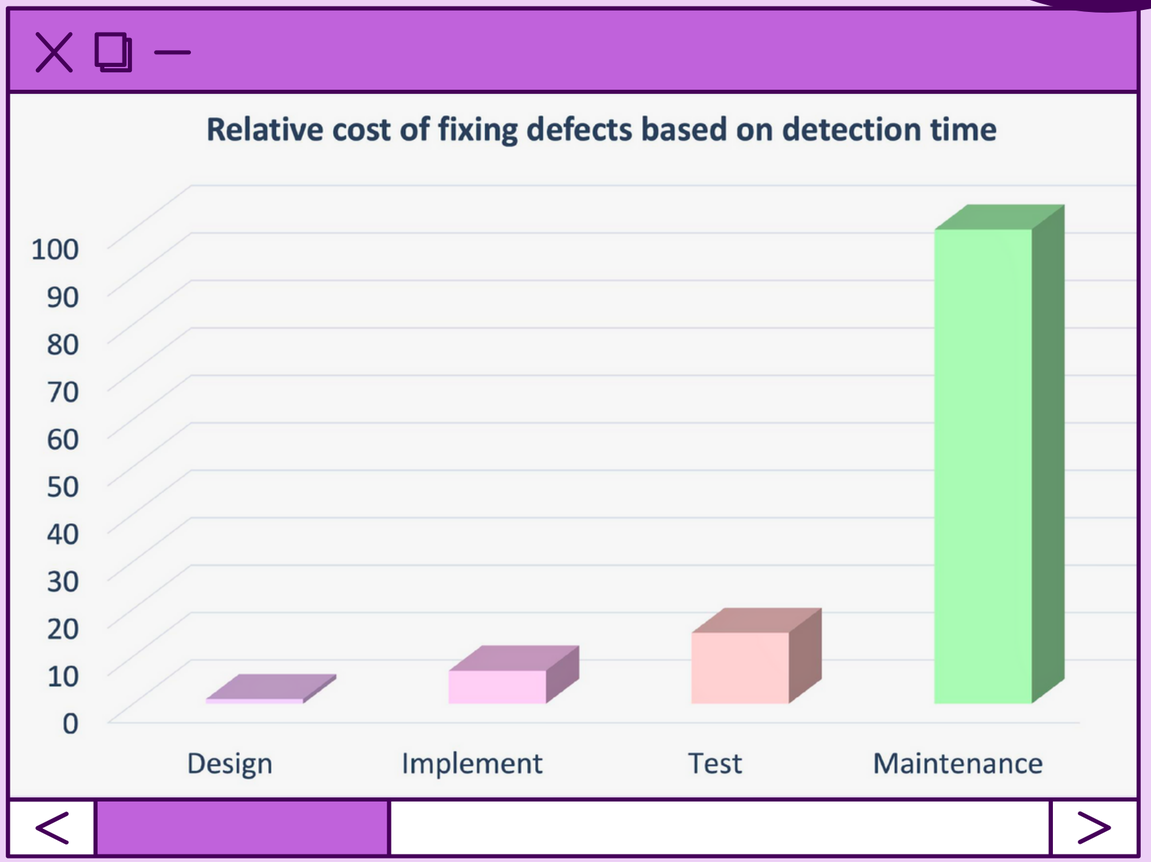
🦠 Bugs in the SDLC



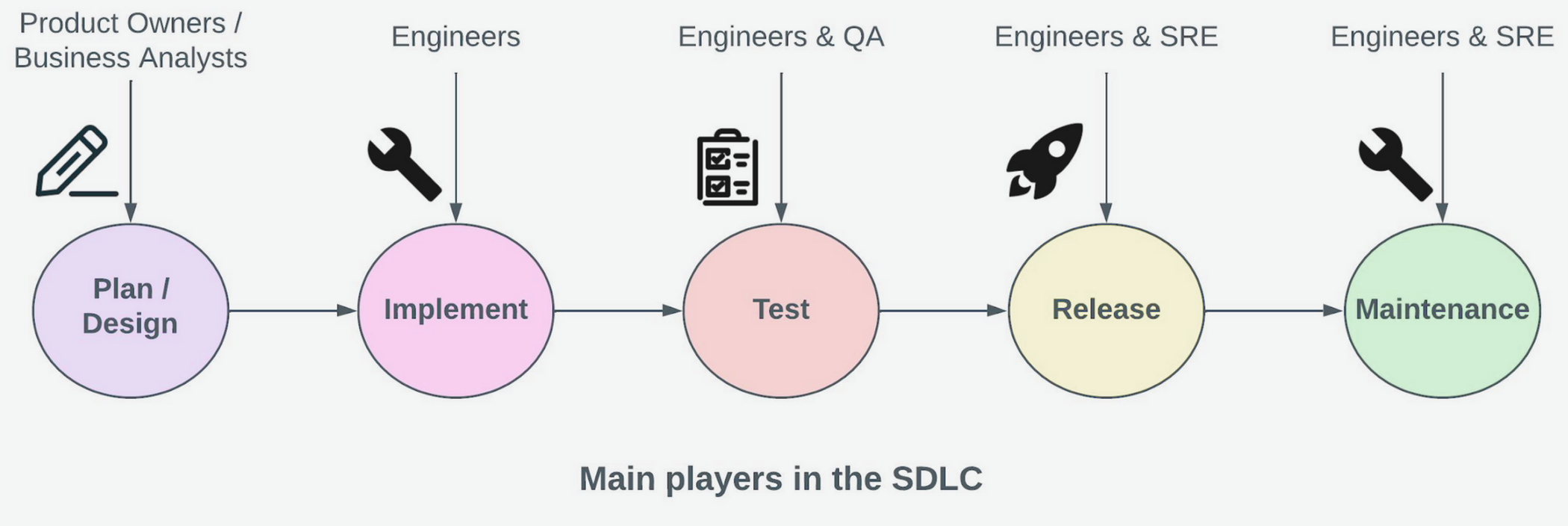
💰Exponential costs

- Detect early, detect often to avoid delays and increased costs (the **“shift left”** motto)
- The cost of fixing bugs increases up to 100 times when identified after release

(Source: IBM study)

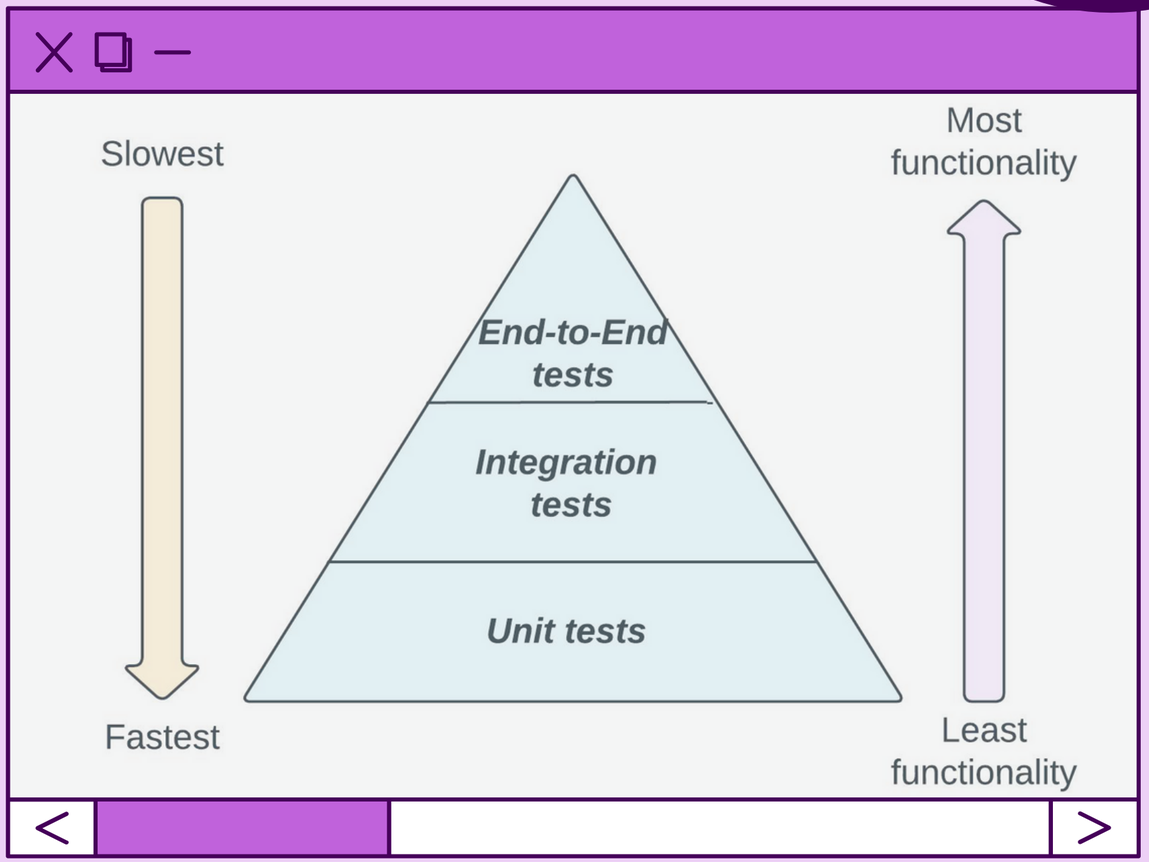


💻 An engineer's life...



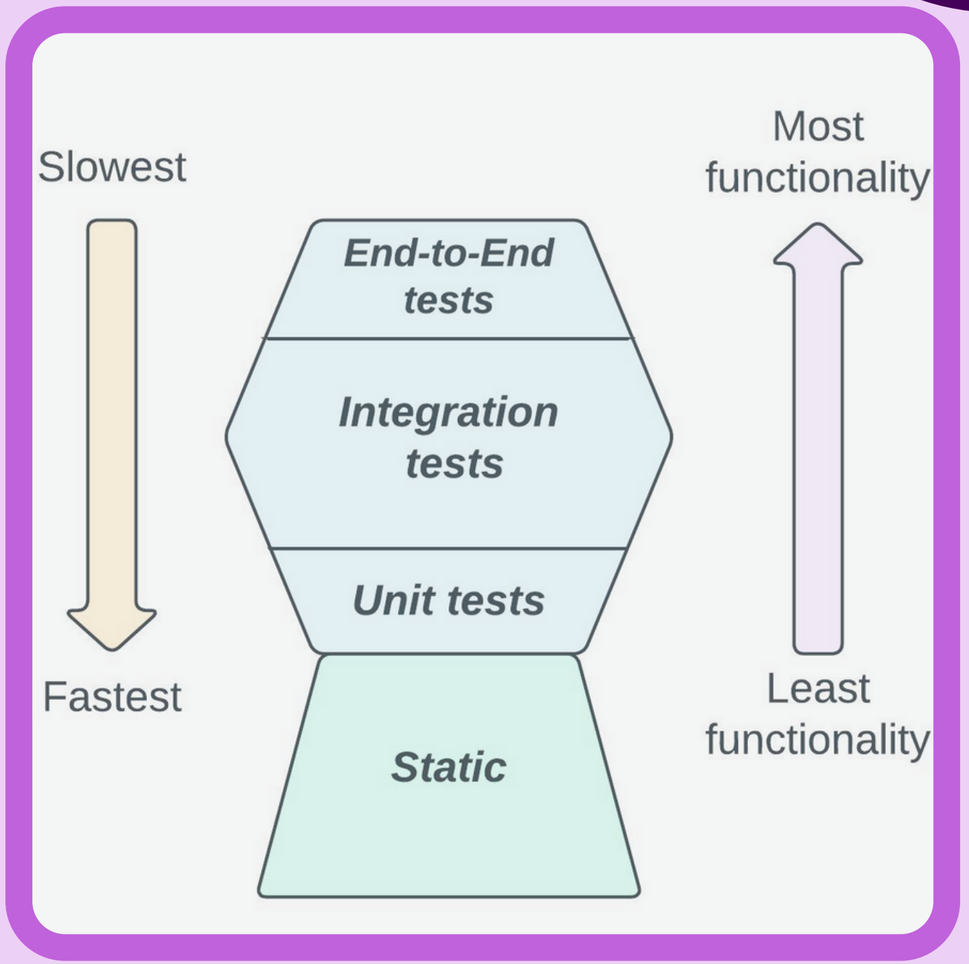
The testing pyramid

- **Unit tests** verify internal code mechanisms
- **Integration tests** verify multiple units work well together
- **End-to-end tests** verify user interactions



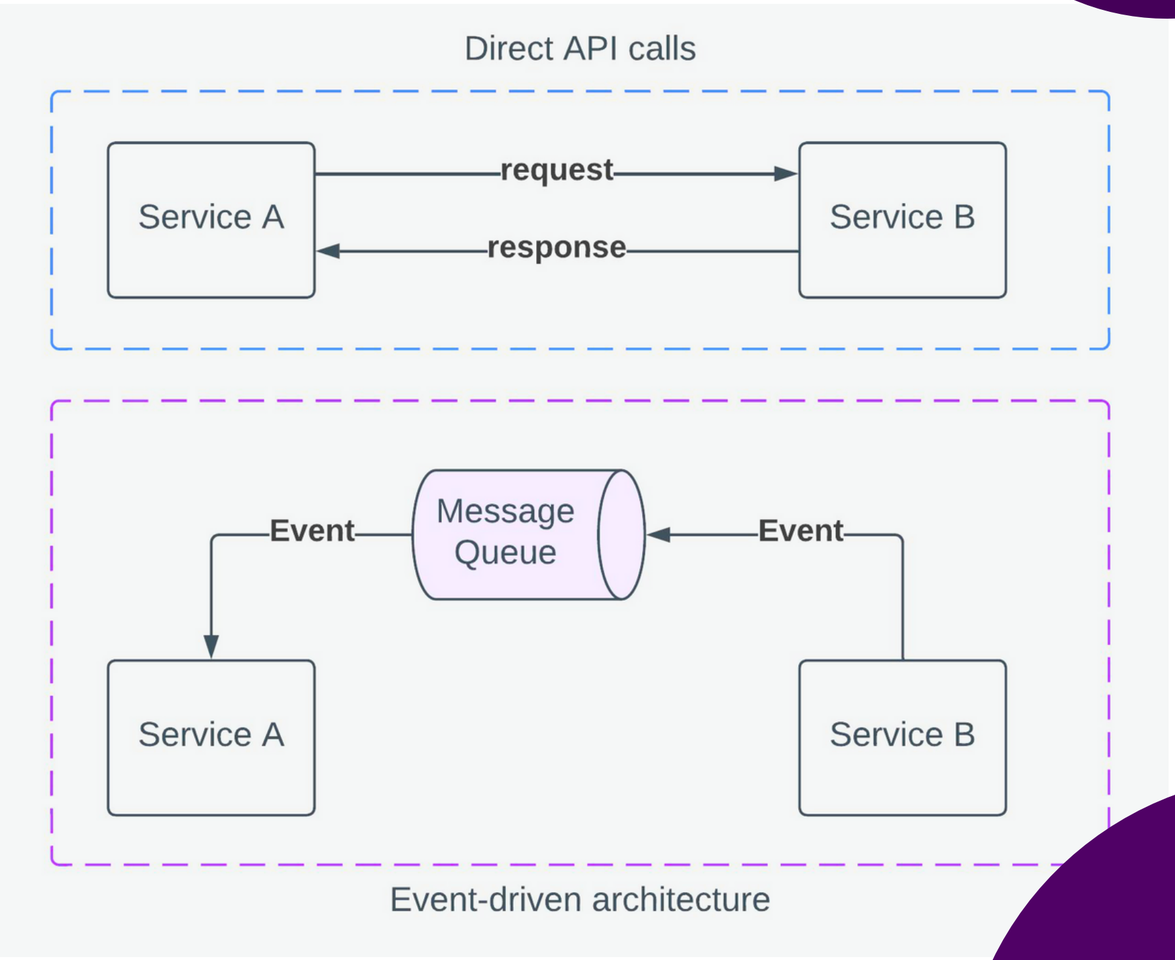
🏆 The testing trophy

- Tests have diminishing returns and can also add a maintenance burden.
- Common static checks are:
  - Reviews
  - Static analysis
  - Checkstyle
  - Linters
- Code coverage should be in the **80-90% range**



🧐A closer look...

- Microservices change without any central oversight and are released at different times
- They might directly integrate with each other or use event driven architectures such as event buses/queues



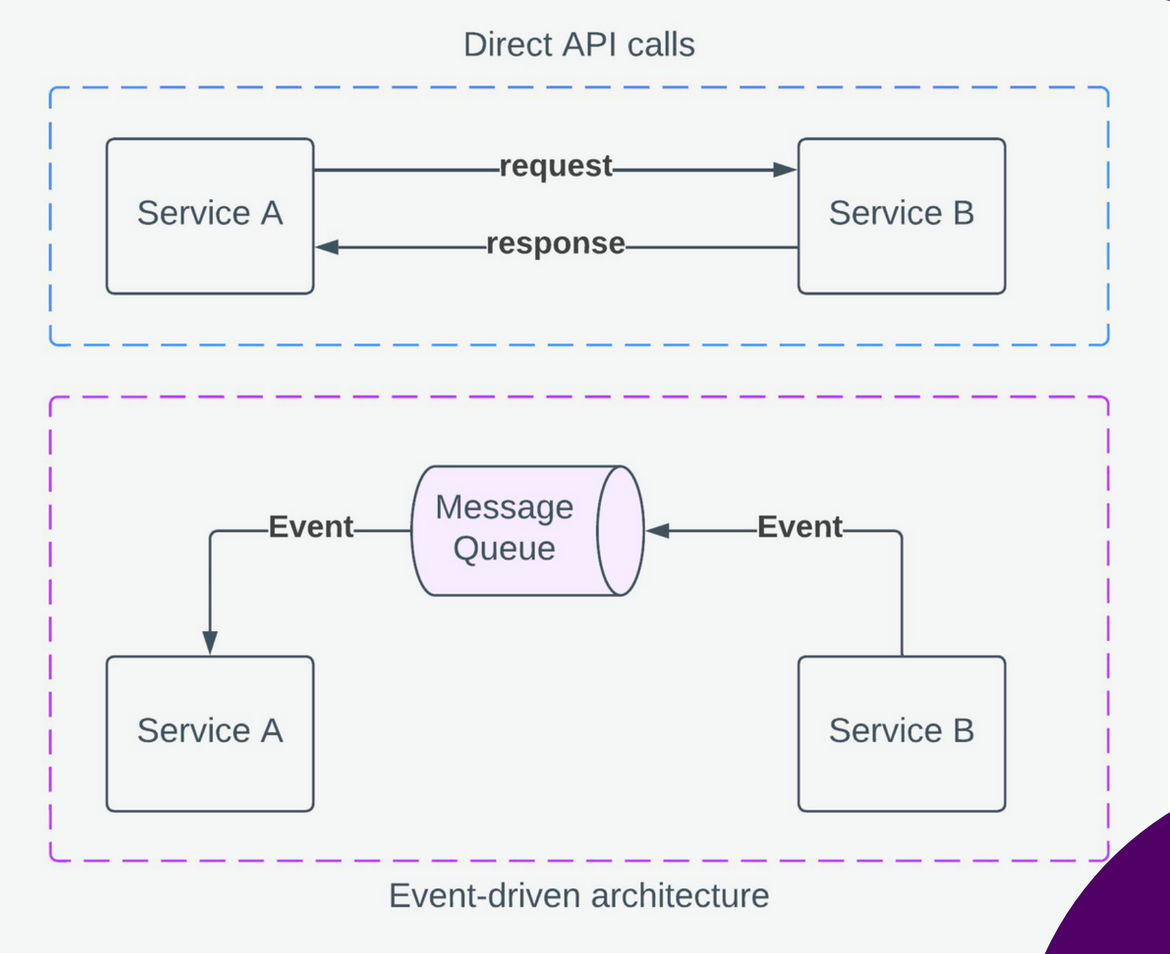
😱 Everything can go wrong!

Direct API calls

- Request & response format issues
- Incorrect service behaviour
- Service outages & high latency

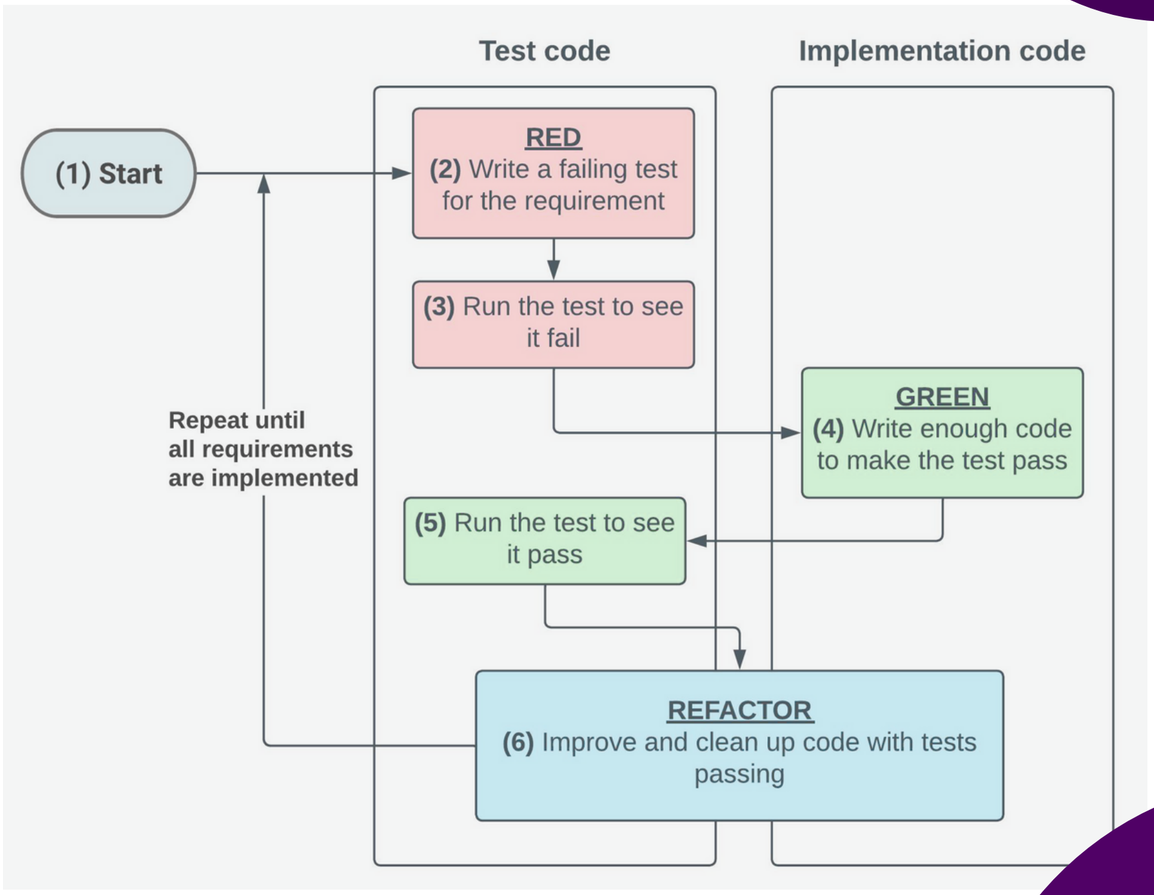
Event-driven architecture

- Event payload format issues
- Message broker outages
- Events acknowledged but not processed



🛠️Let’s start testing!

- **Unit Tests** are written alongside implementation using TDD
- Asserts the logic of the **Unit Under Test (UUT)** in isolation
- Test setup typically follows the **Arrange-Act-Assert (AAA)** structure



1 Unit testing in Go

- In Go, packages are the smallest unit under test as they are a **self-contained mini-API**.
- Tests are the **first clients/ consumers** of our mini-APIs.
- Tests are functions that satisfy a few conventions.

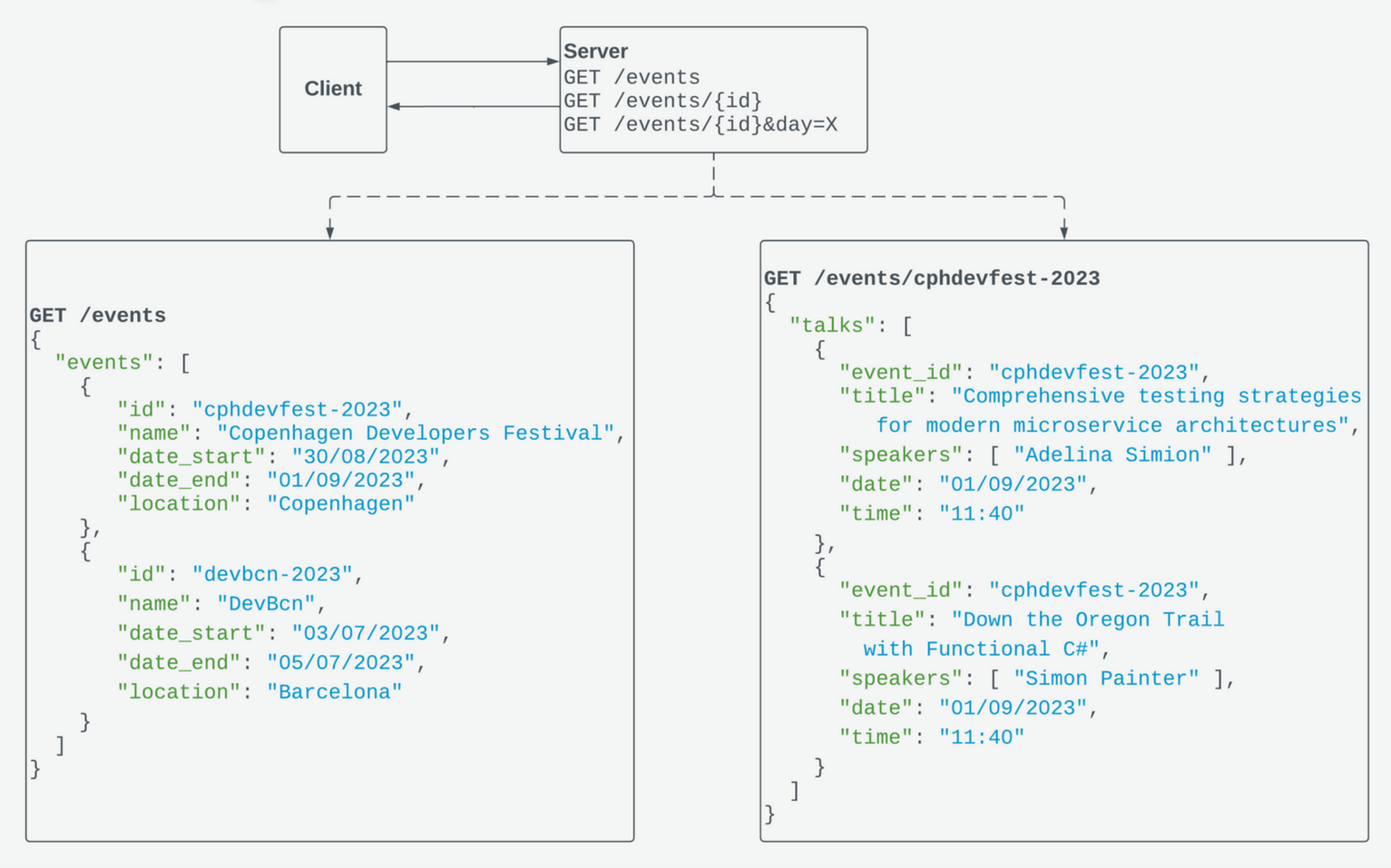
```go
func SayHello(name string) string {
  return fmt.Sprintf("Hello,%s!", name)
}

func TestSayHello(t *testing.T) {
  names := []string{"Anna","Belle"}
  for_, n := range names {
    t.Run(n, func (t *testing.T) {
      want := "Hello, "+ n +"!"
      got := SayHello(n)
      if got != want {
        t.Fatalf("got:%s; want:%s", got, want)
      }
    })
  }
}
```

🧐 Fuzz testing

- Automated tests that are run using the same testing commands.
- **Fuzzed tests** generate values, making it easy to write many unit tests without having to manually write test cases.
- Help us to ensure **code robustness** and **cover edge cases**

```
func FuzzSayHello(f *testing.F) {
  f.Add("Anna")
  f.Add("Belle")
  f.Fuzz(func(t *testing.T, n string) {
    want :="Hello, "+ n +"!"
    got := SayHello(n)
    if got != want {
      t.Fatalf("got:%s; want:%s", got, want)
    }
  })
}
```

Introducing the Conference Talks service!



Show me the code!

github.com/addetz/testing-strategies-demo

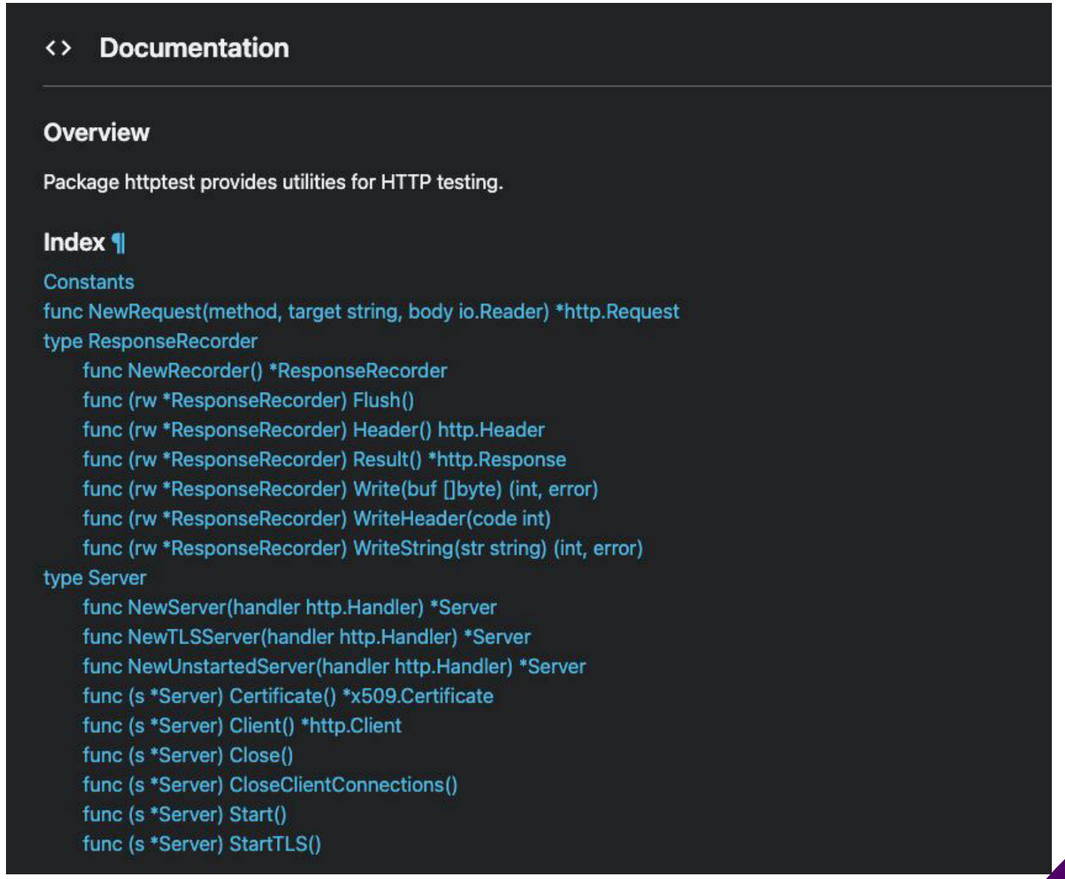
🔺 Moving up the testing pyramid!

	Integration tests	**End-to-end tests**
Purpose	Test integration with external and internal modules	Test user flow and complete user experience
Cost	+ Fast & cheap	- Slow & expensive
Timing	+ Performed earlier in the SDLC	- Performed at the end of the development cycle, when application is running
Scope	+ Ensure that a component works with code that it does not own	- Ensure that specific user workflows perform correctly

💎 The httptest library

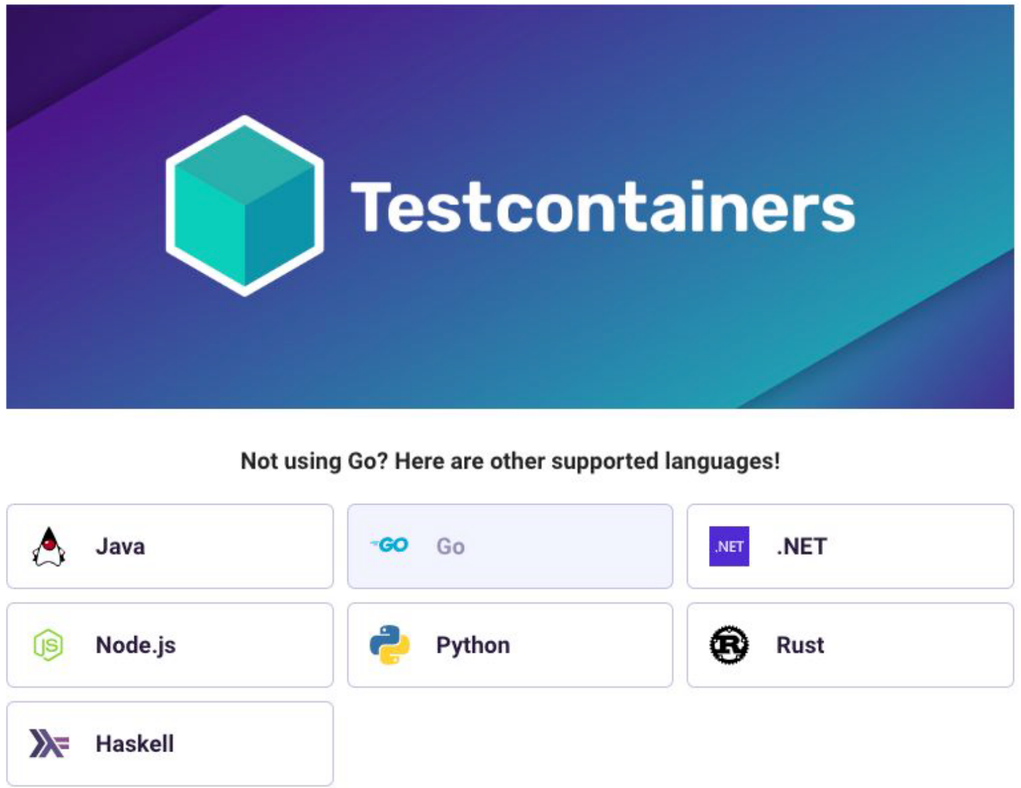
- Starts a test server under the hood and allows us to verify HTTP requests and responses
- Tests look very similar to client code, making it easier for us design client & server integrations

pkg.go.dev/net/http/httptest



💎 The testcontainers project

- A project which makes it easy to manage containers used for integration and end-to-end tests
- Bundles together container management together with code writing, simplifying test setup



github.com/testcontainers

Show me the code!

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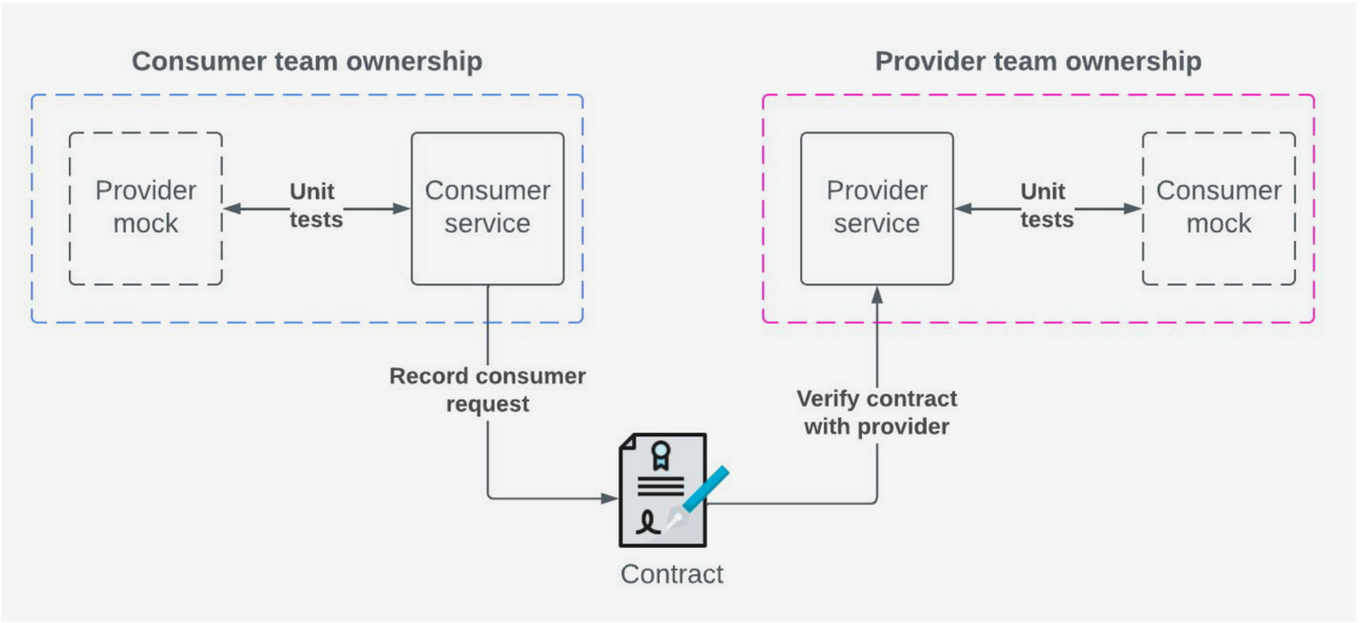
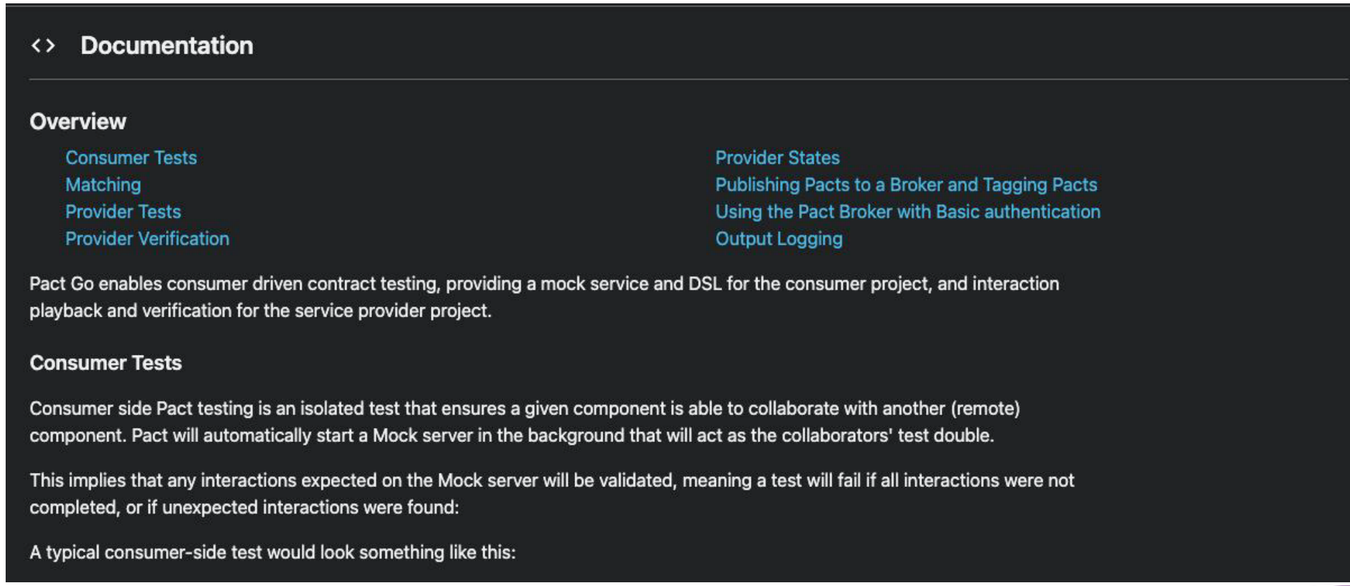
🤝 Contract testing

- The **consumer** issues the request for data from either a queue or service
- The **provider** responds to the request and sends the data
- The **contract** records the expectations of both the consumer and provider, allowing us to establish a common language



💎 The pact tool

- Contract testing framework with libraries in over 10 languages
- Provides:
  - mocking
  - verification
  - domain-specific language (DSL)
  - playback capabilities



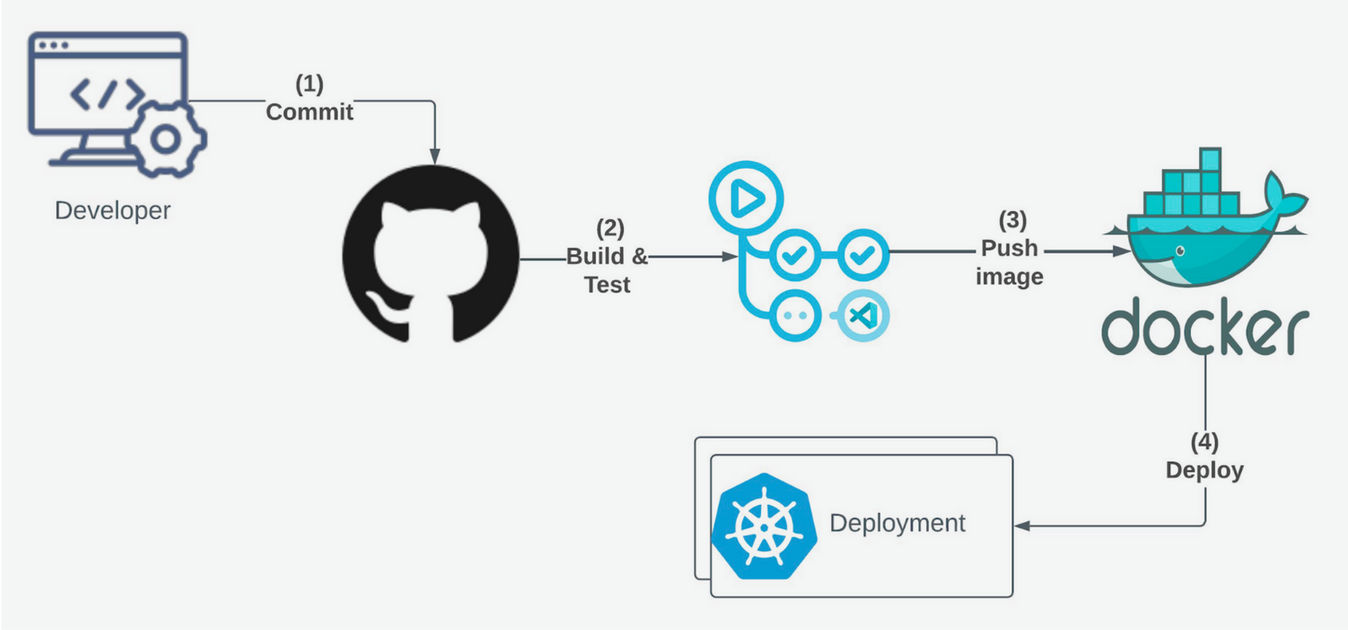
 github.com/pact-foundation

Show me the code!

github.com/addetz/testing-strategies-demo

🚦 Making tests quality gates

- For consistency, tests should be run as part of the CI/CD pipelines to avoid outages, bugs and regressions
- Unit tests are usually run on all branches, while the costlier tests are run on the **main branch only**
- **GitHub Actions** are a popular solution for creating custom CI/CD pipelines



Show me the code!

github.com/addetz/testing-strategies-demo

✅ Summary

TYPES OF TESTS

Write tests at all levels: unit, integration, end-to-end and contract

QUALITY GATES

Tests should be your quality gates to prevent outages

OWNERSHIP

Embrace a testing and quality culture in your teams

Thank you! ❤️

Happy testing!

github.com/addetz/testing-strategies-demo

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