Testing in an Elixir world

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Agenda

- Specifications and software development
- Why testing?
- Base test concepts
  - Types of test
  - Test Pyramid
  - Test Clarity
- Use Case with **Elixir**
  - Outside-in approach
  - Refactoring code with tests
  - Test double with fake clients
  - Doctests

When we start a user story, read the description, the acceptance criteria, and start coding

However...

Are you bringing the specifications into code?

#CodeBEAMSTO

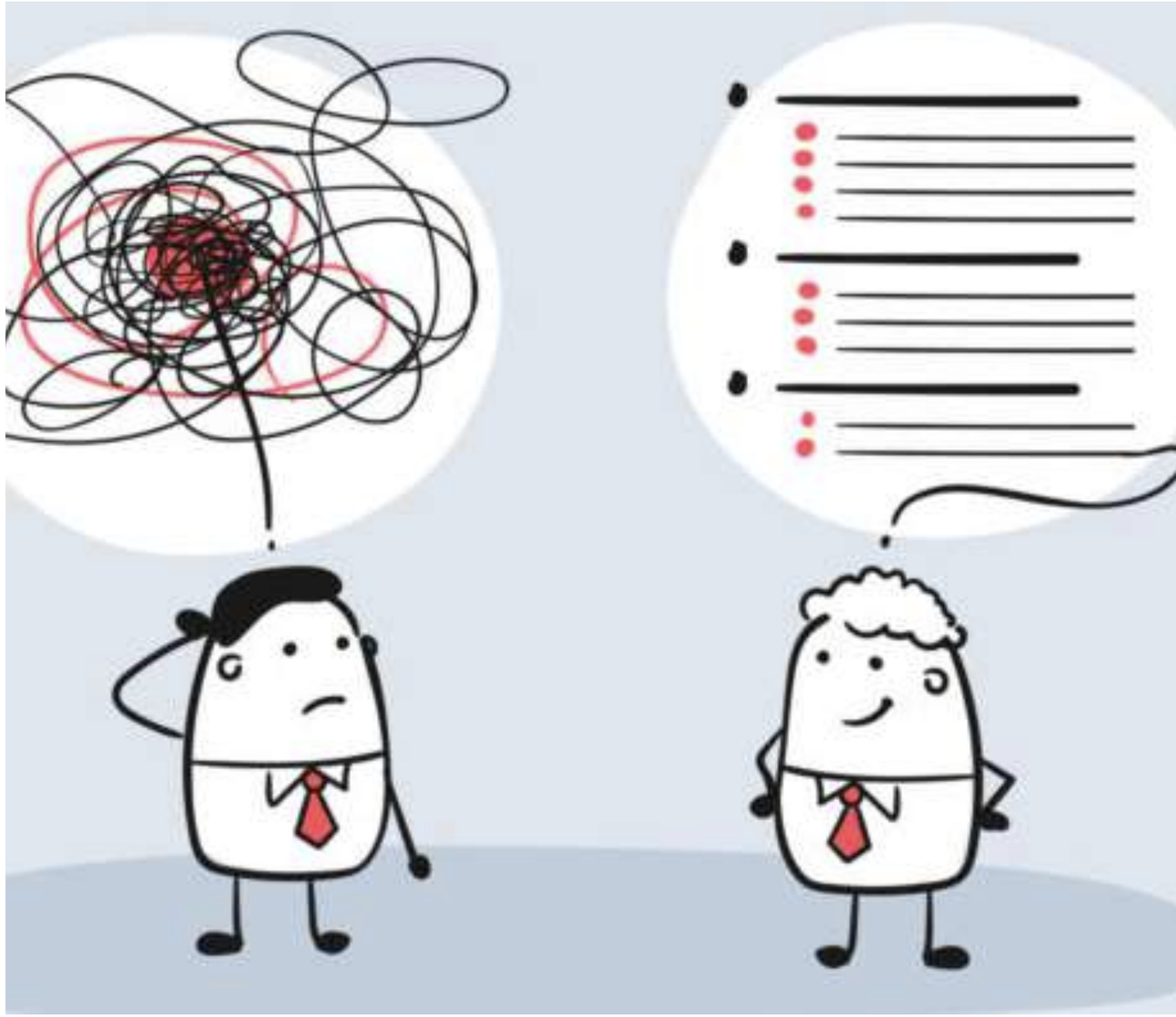
Are you confident about your deliverables?

Why testing?

[x] Being **self-confident**

Why testing?

[x] Being **self-confident**
[x] Organizing thoughts



Why testing?

[x] Being **self-confident**
[x] Organizing thoughts
[x] Keeping the **costs low**

Why testing?

[x] Being **self-confident**
[x] Organizing thoughts
[x] Keeping the **costs low**
[x] Bringing **quality** to the code

What are the types of tests?

Acceptance:

- Express a usage scenario.
- End to end
- Close to the UI
- Slow
- Guarantee External Quality

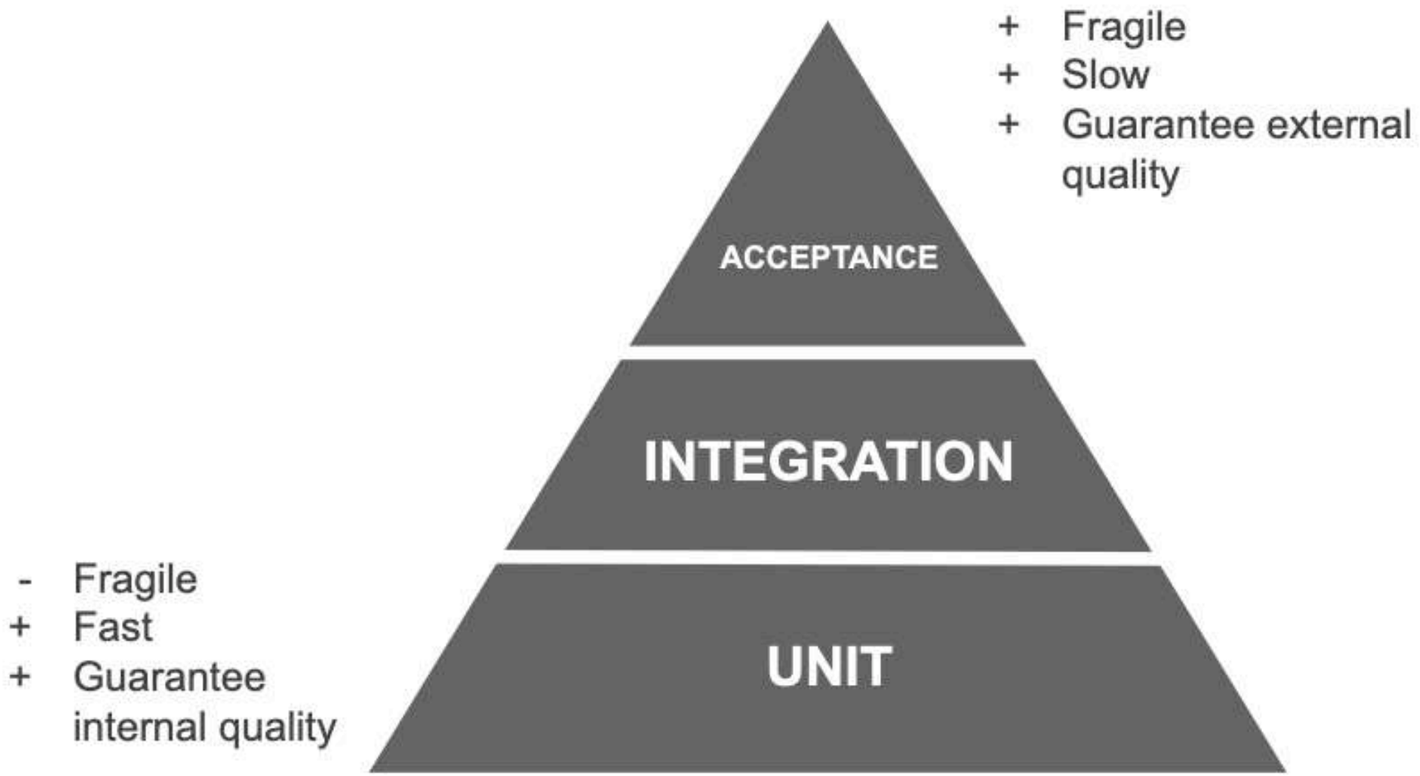
Integration:

- Test between acceptance and unit
- Test the behavior of 2 or more entities

Unit:

- Tests the behavior of one entity
- Earlier detect mistakes
- Run Faster
- Guarantee internal quality
- Easier to fix mistakes

Test pyramid



Imagine that we have an app called Greenbox

Greenbox

Online store that sells
organic beauty products,
where users can choose a different variety of
products and build its own box.

→ We have a stock that changes its prices every

10 minutes, due to our crazy promotions.

Let's practice?

As a User, I want to fetch products from abcdpricing.com so that we can store the current name and price of a given product.

Acceptance Criteria:

- All *id*, *products name* and *price* should be fetched time to time.
- The product name should be *capitalized*
- The price should be in a dollar format, like: *$12.50*

Basically what we have to do:

1) *Fetch Products* from the API
2) Build a *structure* with id, capitalized name, and price
3) Build an interface to consume the data

Let's use an Outside-in approach

What is the primary outside layer of our tasks?

[] *Fetch Products* from the API
[] Build a *structure* with id, capitalized name, and price
[] Build an interface to consume the data

What is the primary outside layer of our tasks?

[] Fetch Products from the API

[] Build a structure with id, capitalized name, and price

[I] Build an interface to consume the data

To fetch the products time to time, we are going to use a GenServer

What is a GenServer?

"A GenServer is a process like any other process in Elixir, and it can be used to keep state, execute code asynchronously and so on."
-- Elixir Documentation

```elixir
# [1] Consume the data

defmodule GreenBox.PriceUpdater do
  use GenServer

  def start_link do
    GenServer.start_link(__MODULE__, [])
  end

  def init(state) do
    {:ok, state}
  end
```

```elixir
# [1] Consume the data

def list_products(pid) do
  GenServer.call(pid, :list_products)
end

def handle_call(:list_products, _, state) do
  {:reply, state, state}
end
```

What is the primary outside layer of our tasks?

[2] Fetch Products from the API

[] Build a structure with id, capitalized name, and price

[I] Build an interface to consume the data

```elixir
# [2] Fetch Products from the API

defmodule GreenBox.PriceUpdater do
  use GenServer

  def start_link do
    GenServer.start_link(__MODULE__, [])
  end

  def init(_) do
    state = fetch_products()
    schedule_work()
    {:ok, state}
  end
```

```elixir
# [2] Fetch Products from the API

@doc """
Run the job and reschedule it to run again after some time.
"""
def handle_info(:get_products, _state) do
  products = fetch_products()
  schedule_work()

  {:noreply, products}
end

defp fetch_products do
  response = HTTPoison.get!("http://abcdpricing.com/products")
  Poison.decode!(response.body)
end

@time_to_consume 10000 * 60 # 10 minutes
defp schedule_work do
  Process.send_after(self(), :get_products, @time_to_consume)
end
```

What is the primary outside layer of our tasks?

[2] Fetch Products from the API

[3] Build a structure with id, capitalized name and price

[1] Build an interface to consume the data

```
# [3] Build a structure with id, capitalized name and price

def init(_) do
  state = build_products()
  schedule_work()
  {:ok, state}
end

defp build_products do
  fetch_products()
  |> process_products()
end
```

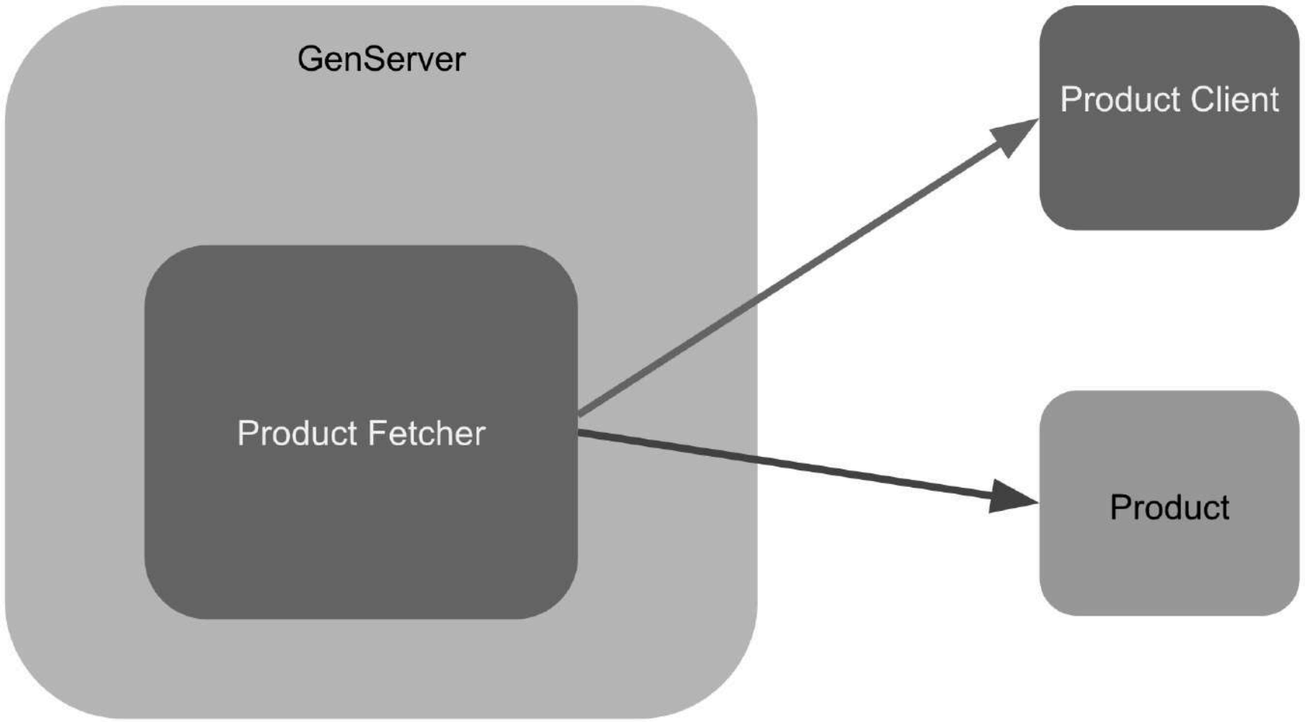
```elixir
# [3] Build a structure with id, capitalized name and price

defp fetch_products do
  response = HTTPoison.get!("http://abcdpricing.com/products")
  Poison.decode!(response.body)
end

defp process_products(products) do
  Enum.map(products, fn %{id: id, name: name, price: price} ->
    new_name = String.capitalize(name)
    new_price = "$#{price/100}"
    %{
      id: id,
      name: new_name,
      price: new_price
    }
  end)
end
```

How can I test a GenServer?

Be careful to not test your servers through the callbacks otherwise you are going to test the GenServer implementation.

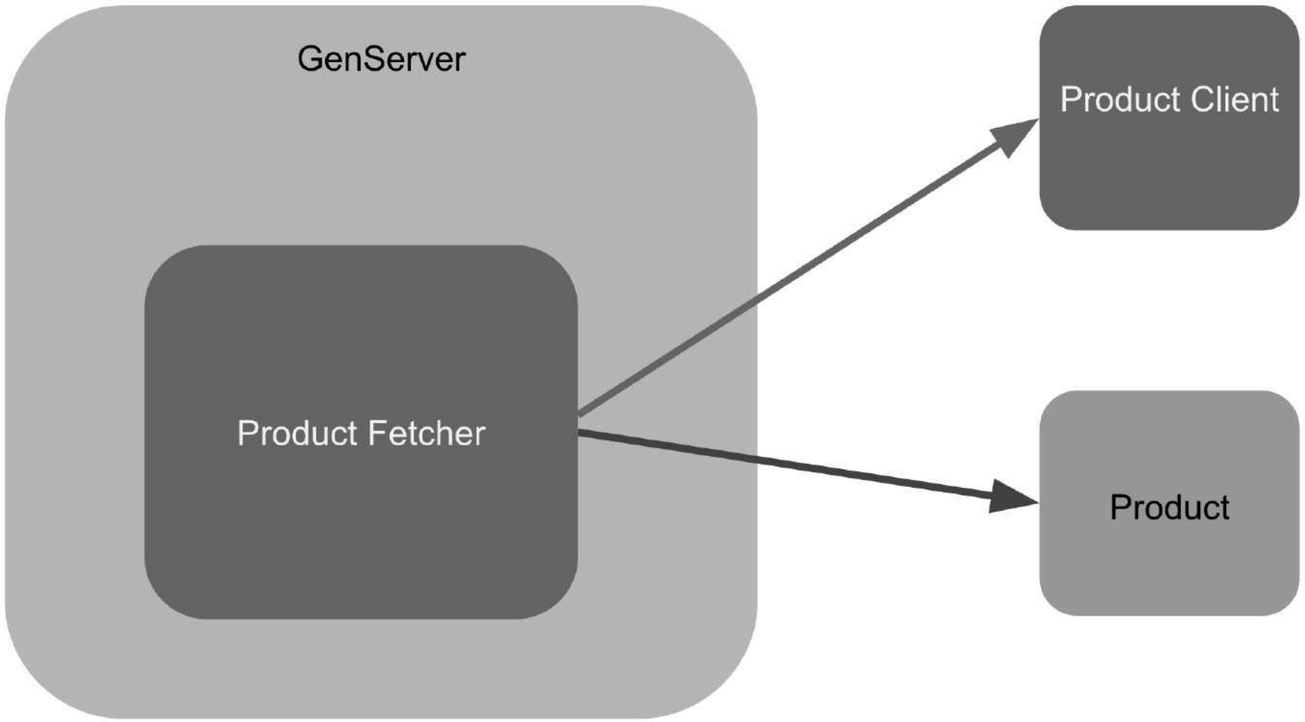
Change your Design!

Fetch Products Architecture



Let's build an integration test to guide the development

Fetch Products Architecture



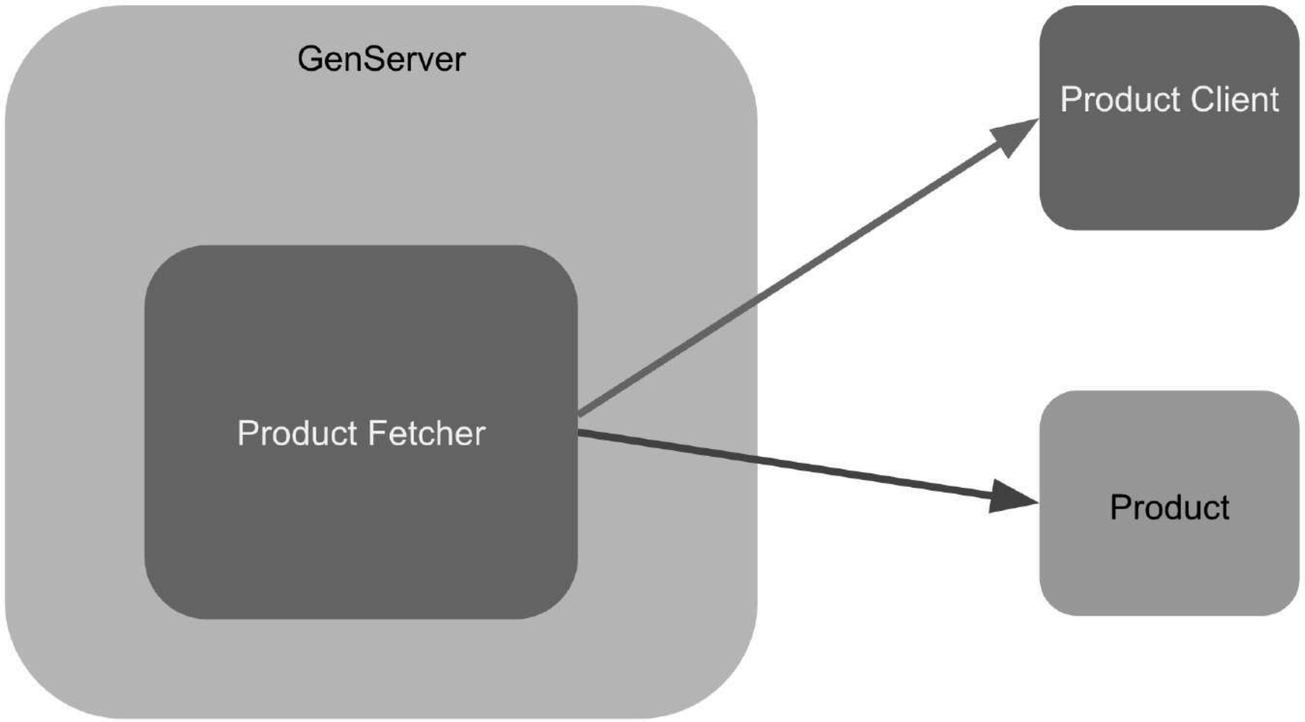
```elixir
# Let's build an INTEGRATION TEST

defmodule Greenbox.ProductFetcherTest do
  use ExUnit.Case, async: true
  alias Greenbox.ProductFetcher

  # Specifications into code
  describe "Given a request to fetch a list of products" do
    test "builds a list of products with id, capitalized name and price in dollar" do
      products = ProductFetcher.build()

      assert [
        %{id: "1234", name: "Blue ocean cream", price: _},
        %{id: "1235", name: "Sea soap", price: _}
      ] = products
    end
```

```
# Let tests guide the development

test "builds a product with the price with a dollar sign" do
  product =
    ProductFetcher.build()
    |> List.first()

  # Expected format "$12.45"
  assert Regex.match?(~r(\$\d+\.\d+), product.price)
end
```

Product Fetcher - A new entity

```
defmodule Greenbox.ProductFetcher do
  def build do
    fetch_products()
    |> process_products()
  end

  defp fetch_products do
    response = HTTPoison.get!("http://abcdpricing.com/products")
    Poison.decode!(response.body)
  end

  defp process_products(products) do
    Enum.map(products, fn %{id: id, name: name, price: price} ->
      %{
        id: id,
        name: capitalize_name(name),
        price: price_to_money(price)
      }
    end)
  end
```

Fetch Products Architecture

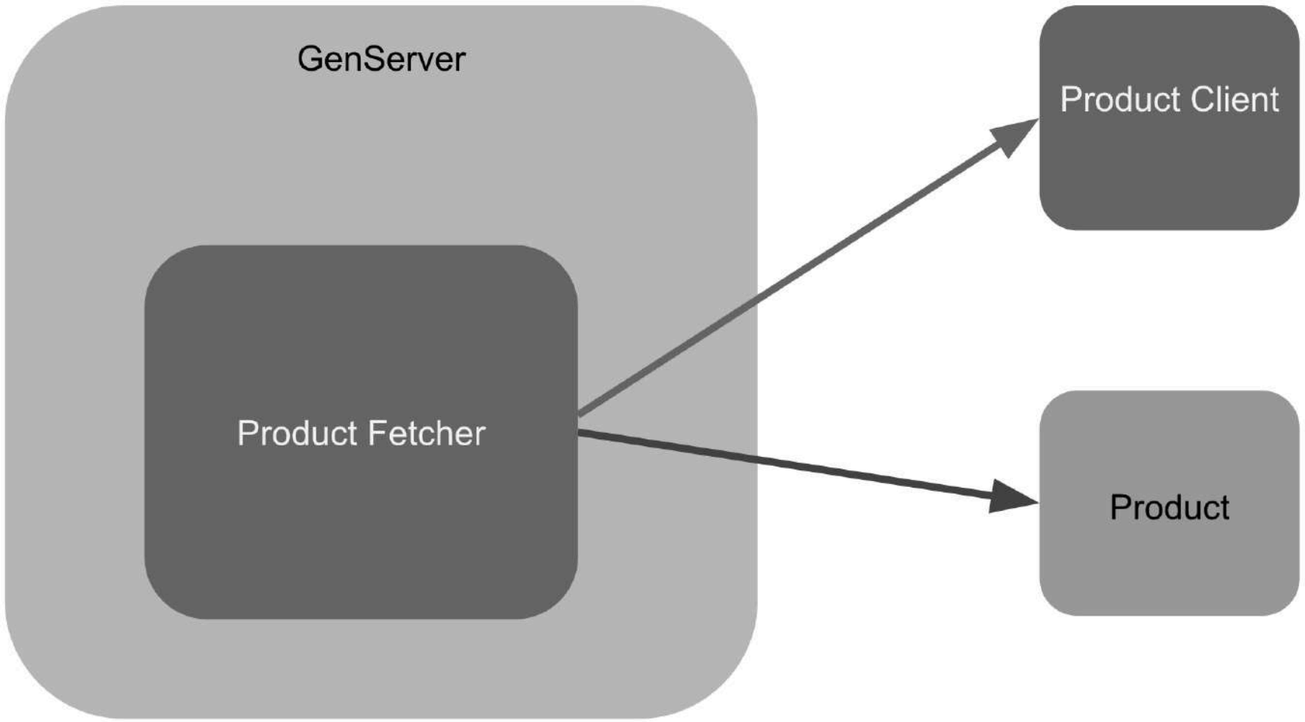


Product Fetcher, is building a Product Structure...

```
defp process_products(products) do
  Enum.map(products, fn %{id: id, name: name, price: price} ->
    %{
      id: id,
      name: capitalize_name(name),
      price: price_to_money(price)
    }
  end)
end
```

```elixir
# Listen to your code

defp price_to_money(price) do
  "$#{price / 100}"
end

defp capitalize_name(name) do
  String.capitalize(name)
end
```

Fetch Products Architecture



Build the *unit tests* to handle product structure

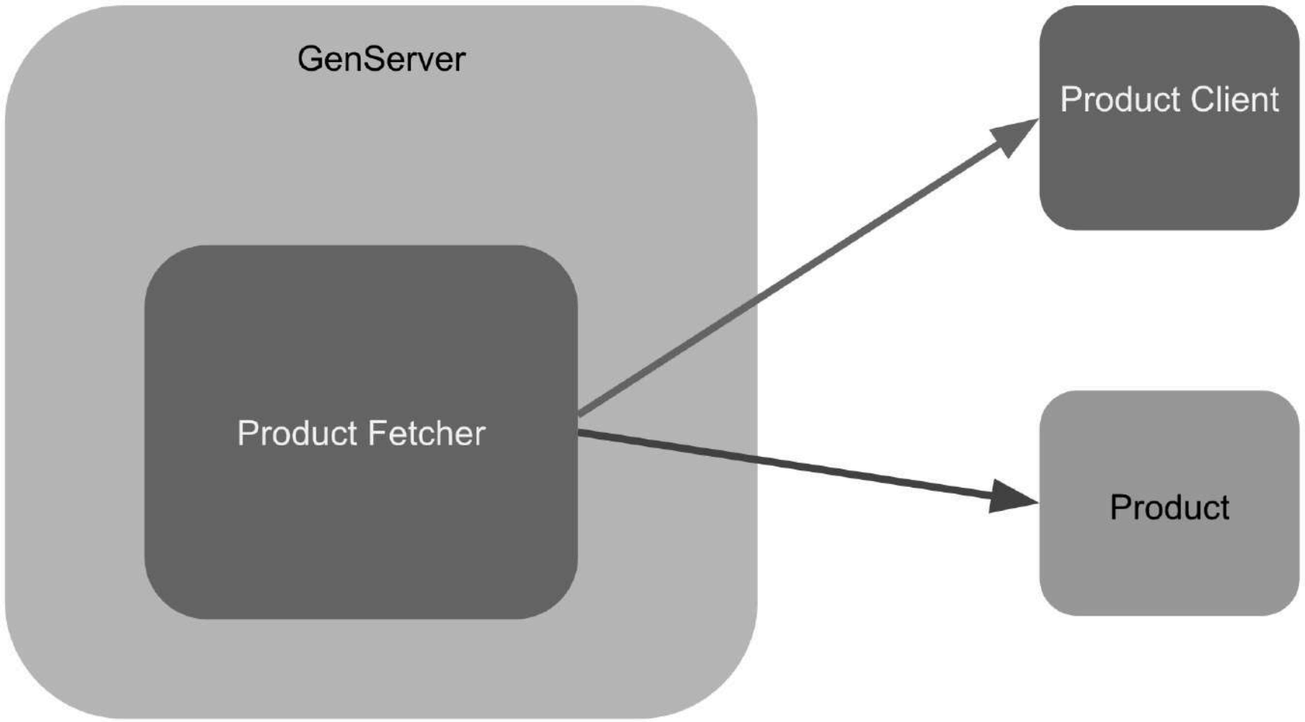
```
defmodule Greenbox.ProductTest do
  use ExUnit.Case, async: true
  alias Greenbox.Product

  describe "Given a product" do
    test "transforms its name by capitalizing it" do
      # Setup
      product_name = "BLUE SOAP"

      # Exercise
      capitalized_name = Product.capitalize_name(product_name)

      # Verify
      assert capitalized_name == "Blue soap"
    end
```

```
# Build the unit tests to handle product structure

    test "transforms the price in cents to dollar" do
      # Setup
      product_price_in_cents = 1253

      # Exercise
      product_price = Product.price_to_money(product_price_in_cents)

      # Verify
      assert product_price == "$12.53"
    end
  end
end
```

Product Entity

```
defmodule Greenbox.Product do
  defstruct [:id, :name, :price]

  def price_to_money(price) do
    "$#{price / 100}"
  end

  def capitalize_name(name) do
    String.capitalize(name)
  end
end
```

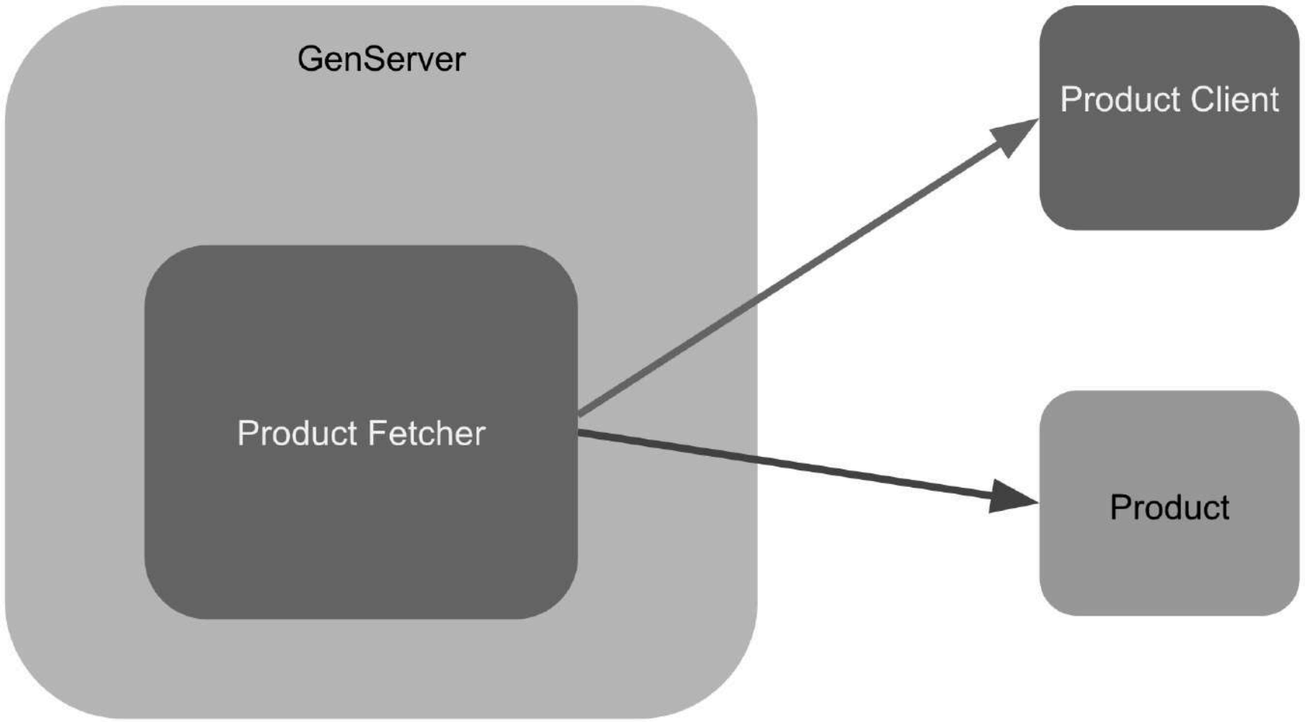
Fetch Products Architecture



And finally, build a client to call the external API

```
defmodule Greenbox.ProductClient do
  def fetch_products do
    response = url() |> HTTPoison.get!()
    Poison.decode!(response.body)
  end

  defp url do
    Application.get_env(:greenbox, :abc_products_url)
  end
end
```

Fetch Products Architecture



Did you notice that we are hitting the API every time we run our tests?

Call to the external API

```
defmodule Greenbox.ProductClient do
  def fetch_products do
    response = url() |> HTTPoison.get!()
    Poison.decode!(response.body)
  end

  defp url do
    Application.get_env(:greenbox, :abc_products_url)
  end
end
```

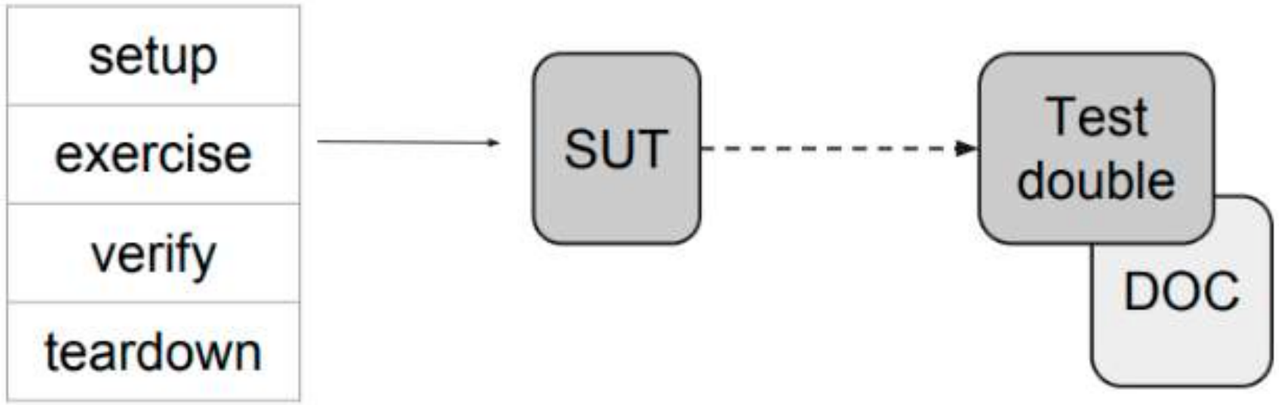
Test Double, how to stub in Elixir?

Test Double

SUT: System Under Test

DOC: Collaborator

Double: Is the object that substitutes the real DOC



Let's start creating our Double

Fake client

```
# test/support/fake_client.ex
defmodule Greenbox.FakeClient do

  def fetch_products do
    [
      %{id: "1234", name: "BLUE OCEAN CREAM", price: Enum.random(8000..10000)},
      %{id: "1235", name: "SEA SOAP", price: Enum.random(5000..60000)}
    ]
  end
end
```

Configure the Fake Client

```elixir
defmodule Greenbox.MixProject do
  use Mix.Project

  def project do
    [
      app: :greenbox,
      version: "0.1.0",
      elixir: "~> 1.7",
      elixirc_paths: elixirc_paths(Mix.env()),
      start_permanent: Mix.env() == :prod,
      deps: deps()
    ]
  end

  # Specifies which paths to compile per environment.
  defp elixirc_paths(:test), do: ["lib", "test/support"]
  defp elixirc_paths(_), do: ["lib"]
end
```

```
# config/config.exs
config :greenbox,
  abc_products_client: Greenbox.ProductClient
```

```
# config/test.exs

config :greenbox,
  abc_products_client: Greenbox.FakeClient
```

Other ways to stub requests in Elixir

- Bypass (https://github.com/PSPDFKit-labs/bypass)
- Mox (https://github.com/plataformatec/mox)

What about Doctest?

Are they supposed to substitute tests?

```
# Doctest

defmodule Greenbox.Product do
  defstruct [:id, :name, :price]

  @doc """
  Converts price in cents to a string money format.

  ## Example:
    iex> Greenbox.Product.price_to_money(1245)
    "$12.45"

  """
  def price_to_money(price) do
    "$#{price / 100}"
  end
```

How tests can reflect specifications and help us to build confident code?

- Write clear *test descriptions*
- Follow the *specifications*
- Think *outside-in*
- Think in the Test *Pyramid*
- Use *stubs* or build fake clients
- *Don't test* callbacks
- Abstract your code into *modules*

Thank you!

https://github.com/rafaelrochasilva/greenbox

https://github.com/rafaelrochasilva/testinginelixir_talk

http://blog.plataformatec.com.br/2018/11/starting-with-elixir-the-study-guide/

References:

https://github.com/plataformatec/mox
https://github.com/PSPDFKit-labs/bypass
https://github.com/keathley/wallaby