REFACTORING ELIXIR FOR MAINTAINABILITY

By Dave Lucia

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When I was a beginner...

I wrote modules and functions that leveraged pattern matching

```elixir
defmodule MyModule do

  def foo(binary) when is_binary(binary), do: String.upcase(binary)

  def foo(%MyStruct{} = struct), do: struct.message
end
```

But... 🤔

1. When does **Pattern Matching** get in the way of good code? 🤖
2. What patterns can reduce **Code Duplication**? 💻 💻 💻
3. **Protocols** and **Behaviours** - When are they useful? 🔨

What will we do for the next 20 minutes?

1. ⚠️ Consider when to **Pattern Match**
2. ❌ Write some bad **Elixir** Code
3. ✅ Make it better with **Protocols**
4. ✅ Learn a bit about how **Protocols** work
5. ✅ Make the code *even better* with **Behaviours**

Who is this guy??

Currently

- Husband and Dog dad
- **SimpleBet** - Platform Software Architect - **Elixir | Rust**

Formerly

- **The Outline** - Founding team member - **Elixir | JavaScript**
- **Bloomberg** - Senior Developer - ***JavaScript | C++***

Pattern matching is 🆒

```
defmodule Expng do
  def png_parse(<< 0x89, 0x50, 0x4E, 0x47, 0x0D, 0x0A, 0x1A, 0x0A,
                 _length :: size(32),
                 "IHDR",
                 width :: size(32),
                 height :: size(32),
                 bit_depth,
                 color_type,
                 compression_method,
                 filter_method,
                 interlace_method,
                 _crc :: size(32),
                 chunks :: binary>>) do
```

Source: https://zohaib.me/binary-pattern-matching-in-elixir/

Pattern matching can be a novelty

```elixir
def foo(%Post{comment: %Comment{author: %Author{favorite_pet: pet}}), do: pet
```

vs

```elixir
def foo(%Post{} = post), do: post.comment.author.favorite_pet
```

Don't Pattern match in function heads

- ❌ To extract nested datastructures
- ❌ To guard against every possible type

```elixir
# This is overly defensive, this should be a programmer error
def render_post(%Comment{} = _comment), do :error
```

Do Pattern match in function heads when..

- ✅ It makes API / Context boundaries explicit
- ✅ Matching on result types

```
def foo({:ok, value}), do: value
def foo({:error, reason}), do: reason
```

- ✅ Parsing binary values
- ✅ You've considered the tradeoffs

Case Study

Let's build a blog 📰

using *Phoenix* and *Ecto*

Post Data Model

```elixir
defmodule Blog.Post do
  use Blog.Web, :model

  schema "posts" do
    field :title, :string
    field :author, :string
    field :body, :string
  end
end
```

Post Template

```
<article>
  <header>
    <h1><%= @post.title %></h1>
    <address><%= @post.author %></address>
  </header>
  <section>
    <%= @post.body %>
  </section>
</article>
```

Blog Features

✅ Text
❌ Titles
❌ Paragraphs
❌ Links
❌ Images
❌ Bold / Italics

Let's 🌶️ it up with some Markdown

```markdown
# Markdown time!

*Hello* **World**!

[Code BEAM SF](https://codesync.global/conferences/code-beam-sf-2019/)
```

Expose a function to render Markdown in templates

```
defmodule Blog.Web.PostView do
  use Blog.Web, :view

  def render_markdown(binary) do
    Blog.Markdown.to_html(binary)
  end
end
```

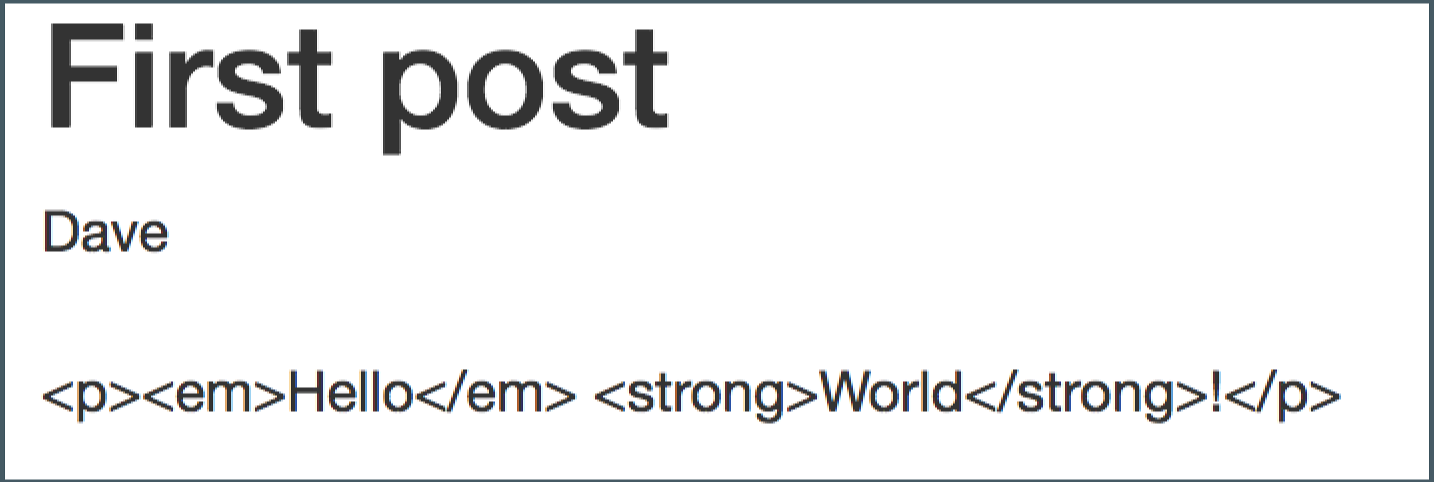
```elixir
defmodule Blog.Markdown do

  def to_html(binary) when is_binary(binary) do
    Cmark.to_html(binary)
  end
end
```

Render the body as Markdown

```
<section>
  <%# Convert the Markdown -> HTML %>
  <%= render_markdown @post.body %>
</section>
```

Our HTML is being escaped 😢



First post

Dave

```
<p><em>Hello</em> <strong>World</strong>!</p>
```

`Phoenix.render/3` returns a safe tuple? 😯

```
iex(2)> Phoenix.View.render(Blog.Web.PostView, "show.html", post: post)
{:safe,
 [[[[[[["" | "<article>\n  <header>\n    <h1>"] | "First post"] |
      "</h1>\n    <address>"] | "Dave"] |
    "</address>\n  </header>\n  <section>\n"] |
   "&lt;p&gt;&lt;em&gt;Hello&lt;/em&gt; &lt;strong&gt;World&lt;/strong&gt;!&lt;/p&gt;\n"] |
  "  </section>\n</article>\n"]}
```

We can see our escaped HTML

```
"&lt;p&gt;&lt;em&gt;Hello&lt;/em&gt; &lt;strong&gt;World&lt;"
```

> The safe tuple annotates that our template is safe and that we don't need to escape its contents because all data has already been encoded.

Thanks for keeping us safe, Phoenix 😉

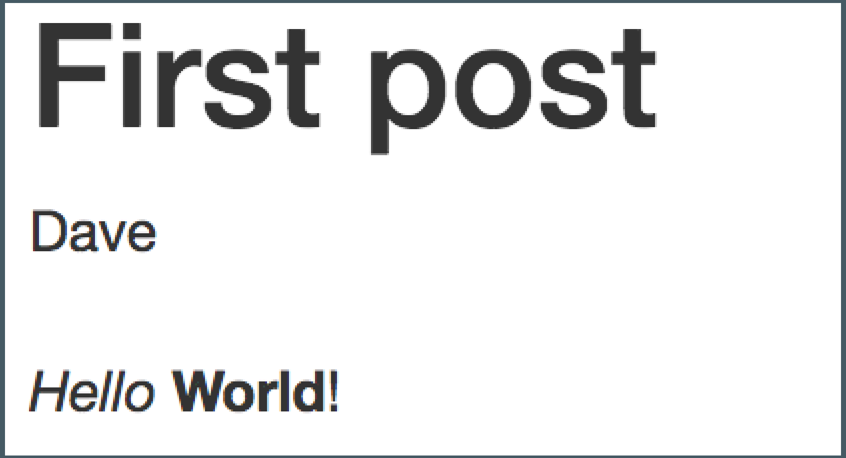
```elixir
# Pseudo typespec
@spec Phoenix.View.render(module(), binary(), term()) :: {:safe, list()}
```

We need our Markdown rendered HTML to go from

`iodata` 👉 `{:safe, iodata}`

`render_markdown/1` now marks the HTML as safe

```
def render_markdown(binary) do
  binary
  |> Markdown.to_html()
  |> Phoenix.HTML.raw() # Convert to {:safe, iodata} tuple
end
```



First post

Dave

Hello **World!**

The Good

✅ We've built the world's simplest blog
✅ We can render Markdown in templates

The Bad

❌ We need have to remember to use the `render_markdown/1` function for any field we want to support Markdown

```
<article>
  <header>
    <h1><%= render_markdown(@post.title) %></h1>
    <h2><%= render_markdown(@post.dek) %></h2>
    <address><%= @post.author %></address>
    <date><%= @post.published_at %></date>
  </header>
  <section>
    <%= render_markdown(@post.body) %>
  </section>
  <footer><%= render_markdown(@post.footer)</footer>
</article>
```

We're here to Refactor for Maintainability ™

Let's refactor by leveraging Protocols

Protocols help you achieve the Open/Closed Principle in Elixir

✅ Open for extension
❌ Closed for modification

> Protocols are a mechanism to achieve polymorphism in Elixir. Dispatching on a protocol is available to any data type as long as it implements the protocol. - Elixir Protocol Guide

```elixir
defprotocol Size do
  @doc "Calculates the size (and not the length!) of a data structure"
  def size(data)
end

defimpl Size, for: BitString do
  def size(string), do: byte_size(string)
end

defimpl Size, for: Map do
  def size(map), do: map_size(map)
end

defimpl Size, for: Tuple do
  def size(tuple), do: tuple_size(tuple)
end
```

```elixir
defmodule Size do
  @doc "Calculates the size (and not the length!) of a data structure"

  def size(string) when is_binary(string), do: byte_size(string)
  def size(map) when is_map(map), do: map_size(map)
  def size(tuple) when is_tuple(tuple), do: tuple_size(tuple)
end
```

We can extend the rendering power of Phoenix by leveraging its `Phoenix.HTML.Safe` Protocol

```
defmodule Blog.Markdown do
  defstruct text: ""

  def to_html(%__MODULE__{text: text}) when is_binary(text) do
    Cmark.to_html(binary)
  end

  defimpl Phoenix.HTML.Safe do
    # Implement the protocol
    def to_iodata(%Blog.Markdown{} = markdown) do
      Blog.Markdown.to_html(markdown)
    end
  end
end
```

```elixir
post = put_in(post.body, Markdown.new(post.body))

Phoenix.View.render(
  Blog.Web.PostView,
  "show.html",
  post: post
)
```

```
<article>
  <header>
    <h1><%= @post.title %></h1>
    <address><%= @post.author %></address>
  </header>
  <section>
    <%# No longer needed -> render_markdown(@post.body) %>
    <%= @post.body %>
  </section>
</article>
```

But wait, we can do better

We still need to remember to wrap in a `Markdown` struct

```
post = put_in(post.body, Markdown.new(post.body))
```

How can we refactor further? 🤔

Behaviours 😎

Behaviours are interfaces 💻

```
def Food do
  @callback is_hotdog?(any()) :: boolean()
end

def Hotdog do
  defstruct [:val]

  @behaviour Food

  def is_hotdog?(%Hotdog{}), do: true
end
```

Lets make `%Markdown{}` implement the `Ecto.Type` Behaviour 💵

- **Type** is the backing type of our Markdown field, which is `:string`
- **Load** takes data from the database, converts it to `%Markdown{}`
- **Dump** takes a `%Markdown{}` struct, validates it, and returns a valid `:string`
- **Cast** is called when casting values for `Ecto.Changeset` or `Ecto.Query`.

```elixir
defmodule Blog.Post do
  use Blog.Web, :model

  schema "posts" do
    field :title, :string
    field :author, :string
    field :body, Blog.Markdown # The custom Ecto.Type
  end
end
```

```elixir
defmodule Blog.Markdown do
  @behaviour Ecto.Type

  def type, do: :string

  def cast(binary) when is_binary(binary) do
    {:ok, %Markdown{text: binary}}
  end

  def load(binary) when is_binary(binary) do
    {:ok, %Markdown{text: binary}}
  end

  def dump(%Markdown{text: binary}) when is_binary(binary) do
    {:ok, binary}
  end
end
```

Now `Post.body` is always a `%Markdown{}`

```
post = Repo.get!(Post, 1)

true = match?(%Markdown{}, post.body)

# No longer needed
# post = put_in(post.body, Markdown.new(post.body))

Phoenix.View.render(
  Blog.Web.PostView,
  "show.html",
  post: post
)
```

Now we have

✅ Built a basic blog with Markdown support
✅ Simplified our templates by leveraging the Phoenix.HTML.Safe Protocol
✅ Automatically casted Markdown fields at the database level with Behaviours

For more info, read my blog post:

Beyond functions in Elixir: Refactoring for Maintainability

Presentation written in the **Marp framework** by Yuki Hattori, a Markdown based presentation framework.

Marp - https://yhatt.github.io/marp/

Presentation - https://davydog187.github.io/code_beam_presentation

Source - https://github.com/davydog187/code_beam_presentation

Thanks!

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