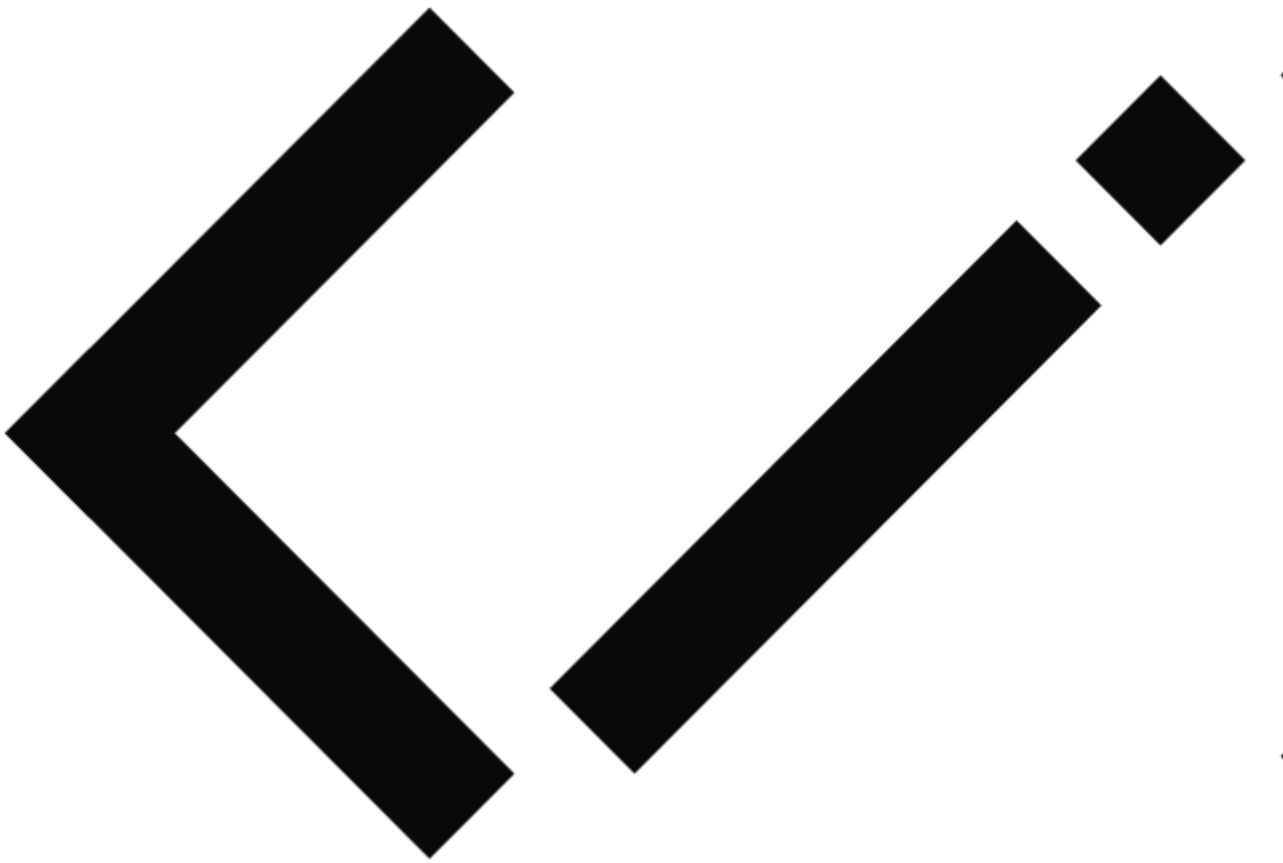
IDOM - It's React, but in Python

IDOM is a new declarative Python package for building highly interactive and composable user interfaces.



IDOM takes inspiration from React, and wherever possible, attempts to achieve parity with the features it cop
than the version of React's often lauded "Hooks" that IDOM implements in Python.

At a glance, the similarities between IDOM and React are rather striking. Below is a React component which d
that updates when a user clicks on it. Immediately following that is the same view implemented in Python us

```
import React, { useState } from react;

function Slideshow() {
  const [index, setIndex] = useState(0);
  return (
```

```
    <img
      src={ `https://picsum.photos/400?image=${index}` }
      onClick={ () => setIndex(index + 1) }
      style={ {cursor: "pointer"} }
    />
  )
}
```

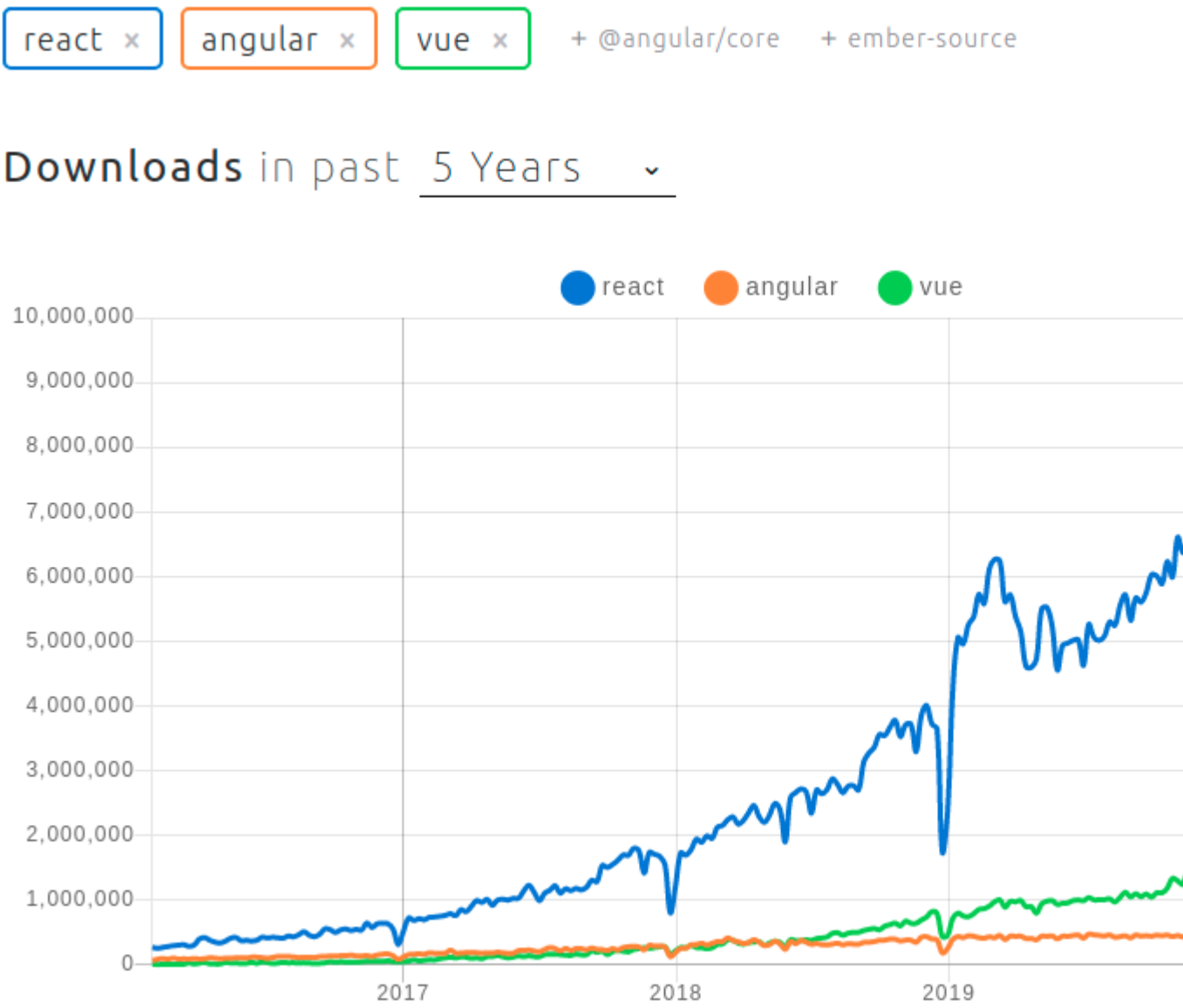
```
import idom

@idom.component
def Slideshow():
    index, set_index = idom.hooks.use_state(0)
    return idom.html.img(
        {
            "src": f"https://picsum.photos/400?image={index}",
            "onClick": lambda event: set_index(index + 1),
            "style": {"cursor": "pointer"},
        }
    )

idom.run(Slideshow)
```

Why Do We Need IDOM?

Over the past 5 years front-end developers seem to have arrived at the conclusion that declarative programm
more simply, mutable state in programs can quickly lead to unsustainable complexity. This trend is largely e
like Vue and React which describe the logic of computations without explicitly stating their control flow.



So what does this have to do with Python and IDOM? Well, because browsers are the de facto "operating syst like Python have had to figure out clever ways to integrate with them. While standard REST APIs are well suit modern browser users expect a higher degree of interactivity than this alone can achieve.

A variety of Python packages have since been created to help solve this problem:

- IPyWidgets - Adds interactive widgets to Jupyter Notebooks
- Plotly Dash - Allows data scientists to produces enterprise-ready analytic apps
- Streamlit - Turns simple Python scripts into interactive dashboards
- Bokeh - An interactive visualization library for modern web browsers

However they each have drawbacks that can make them difficult to use.

1. **Restrictive ecosystems** - UI components developed for one framework cannot be easily ported to any of complex, undocumented, or are structurally inaccesible.

2. **Imperative paradigm** - IPyWidgets and Bokeh have not embraced the same declarative design principles p
3. **Limited layouts** - At their initial inception, the developers of these libraries were driven by the visualizatio create complex UI layouts may not have been a primary engineering goal.

A future article will address specific comparisons to each of the projects mentioned above, but for now, we'l problems above.

Ecosystem Independence

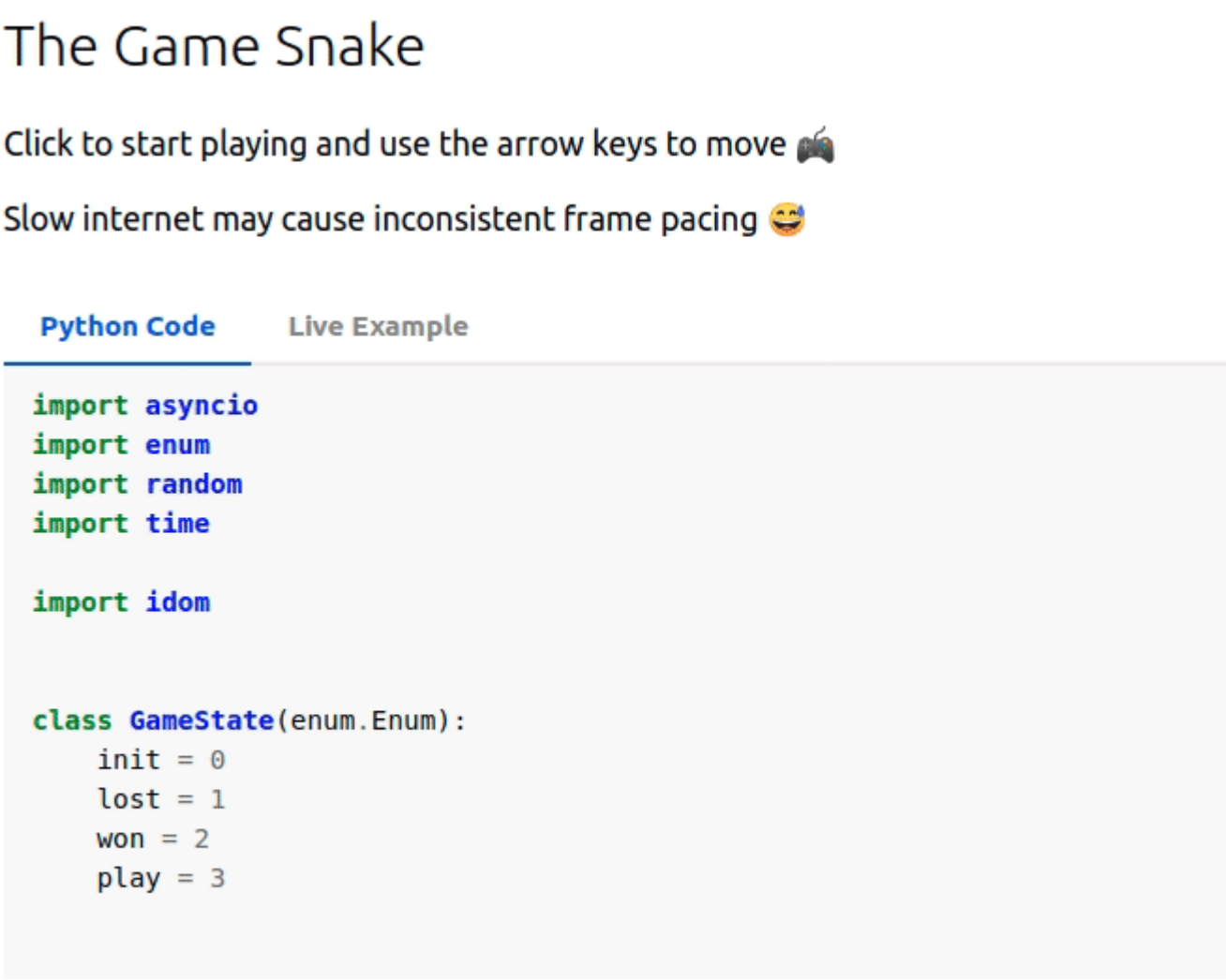
IDOM has a flexible set of core abstractions that allow it to easily interface with its peers. At the time of writi supported (Streamlit and Bokeh are in the works):

- idom-jupyter (try it now with Binder)
- idom-dash

By providing well defined interfaces and straighforward protocols, IDOM makes it easy to swap out any part you need to. For example, if you need to use a different web server for your application, IDOM already has 3 create your own.

- Sanic
- Flask
- Tornado

You can even target your usage of IDOM in your production-grade applications with IDOM's Javascript React c and connect a back-end websocket that's serving up IDOM models. IDOM's own documentation acts as a prim the page is static HTML, but embedded in it are interactive examples that feature live views being served from

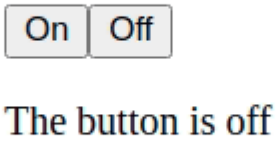


Declarative Components

IDOM, by adopting the hook design pattern from React, inherits many of its aesthetic and functional characte
interfaces are composed of basic HTML elements that are constructed and returned by special functions call
hooks, those components can be made to have state. Consider the component below which returns two butt

```
import idom

@idom.component
def OnOff():
    state, set_state = idom.hooks.use_state(False)
    return idom.html.div(
        idom.html.button({"onClick": lambda event: set_state(True), "On"),
        idom.html.button({"onClick": lambda event: set_state(False), "Off"),
        idom.html.p("The button is " + ("on" if state else "off")),
    )
```



Here's a very high level summary of how it works... the first time a view of the component above is rendered `state` is `False`. The function then returns a series of HTML elements with callbacks that respond to client-s realizes that declaration and displays two buttons with the text `"The button is off"`. Then, when a user clic event is triggered, the associated callback responds to it by setting the `state` to `True`, and a re-render of th machinery again goes to work to update the display, this time though, the text will read `"The button is on"`

Nowhere in the example above does the code describe how to evolve the frontend view when events occur. I this is how it should look. It's then IDOM's responsibility to figure out how to make that happen. This behavior means by which to achieve them is what makes components in IDOM and React "declarative". For comparison approach to defining the same interface might look similar to the following:

```
layout = Layout()

def on_off():
    state_text = html.p(children="The button is off")

    def set_on(event):
        state_text.update(children="The button is on")

    def set_off(event):
        state_text.update(children="The button is off")

    return html.div(
        html.button(on_click=set_on, children="On"),
        html.button(on_click=set_off, children="Off"),
        state_text,
    )

layout.add_element(on_off())
```

In this imperative incarnation, we must explicitely state how the `count_button` updates `count_text` via its `o` `state` is mutated by ammending its `'count'`, a side effect which can be avoided with hooks.

It's important to note that neither declarative nor imperative design principle are inherently better in all circu asserting the way a view should look is easier than describing how it should come to look that way.

Flexible Layouts

Constructing complex layouts is also made easier when done declaratively because the elements, state, and l
in the `OnOff` component shown above, code responsible for managing business logic and manipulating state
responsible for structuring the elements of the layout. The great advantage of this approach is that these se
separate functions if either the logic or the structure becomes too complex:

```
@idom.component
def OnOff():
    return on_off_buttons(*use_on_off_state())

def use_on_off_state():
    """manage logic and state"""
    state, set_state = idom.hooks.use_state(False)

    def set_on():
        set_state(True)

    def set_off()
        set_state(False)

    return state, set_on, set_off

def on_off_buttons(state, set_on, set_off):
    """define element structure"""
    return idom.html.div(
        idom.html.button({"onClick": lambda event: set_on(), "On"),
        idom.html.button({"onClick": lambda event: set_off(), "Off"),
        idom.html.p("The button is " + ("on" if state else "off")),
    )
```

While the refactoring above is overkill in such a simple case, attempting something similar with the ealier im
straighforward because callbacks responsible for defining business logic must hold a reference to the eleme
description of the layout in code is often muddled by semantic limitations of the business logic that make it
grows old.

Conclusion

Building highly interactive web applications as a Python developer has historically been a great challenge. Ho
HTML, CSS, and Python, you can make everything from slideshows to dashboards and use it wherever you ne
an existing web application.

To learn more check it out:

- installation instructions
- where to get started
- interactive examples

- and much more!