

6.1040: Software Studio

Reactive Programming

Arvind Satyanarayan & Daniel Jackson

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Replies

Views

Activity

[Recitation 9 draft review](#)

Recitations



0

2

4h

 Site crashes after implementing a concept

Assignment 5



3

5

5h

[A5 Data Modeling](#)

Assignment 5



1

7

6h

[Implementing all concept in A3,4?](#)

1

10

7h

[Bookmark concept, error on freeId](#)

Assignment 5



5

16

7h

 Vercel create user not working Assignment 5 resolved

2

16

9h

[What are the deliverables for the final milestone?](#)

Assignment 5



3

57

10h

 Validators for Multiple Query Parameters

Assignment 5



1

17

10h

Can I unrequest using a slack day?

Assignments



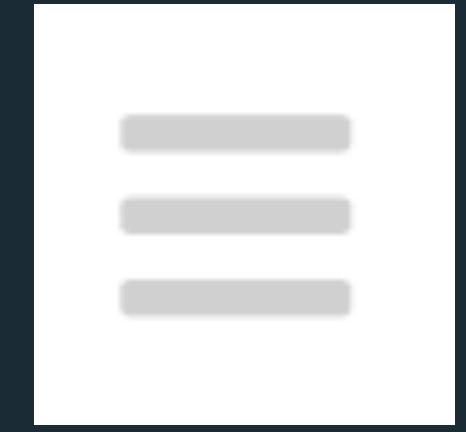
0

18

10h

Pseudo Code

```
while (true) {  
    read mouse click  
  
    if (clicked on Toggle button) showSidebar()  
    else if (clicked on Search button) showSearchbar()  
    else if ...  
}
```



toggle.ts

The screenshot shows a sidebar menu with the following structure:

- Community
 - Everything (selected)
 - Tracked
 - My Posts
 - Admin
 - More
- Categories
 - Announcements
 - Assignments
 - Lectures
- All categories

sidebar.html

The JavaScript *Event Loop*

Call Stack

toggle.ts

6.1040 Software

- Community
- Everything
- Tracked
- My Posts
- Admin
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sidebar.html

Event Queue

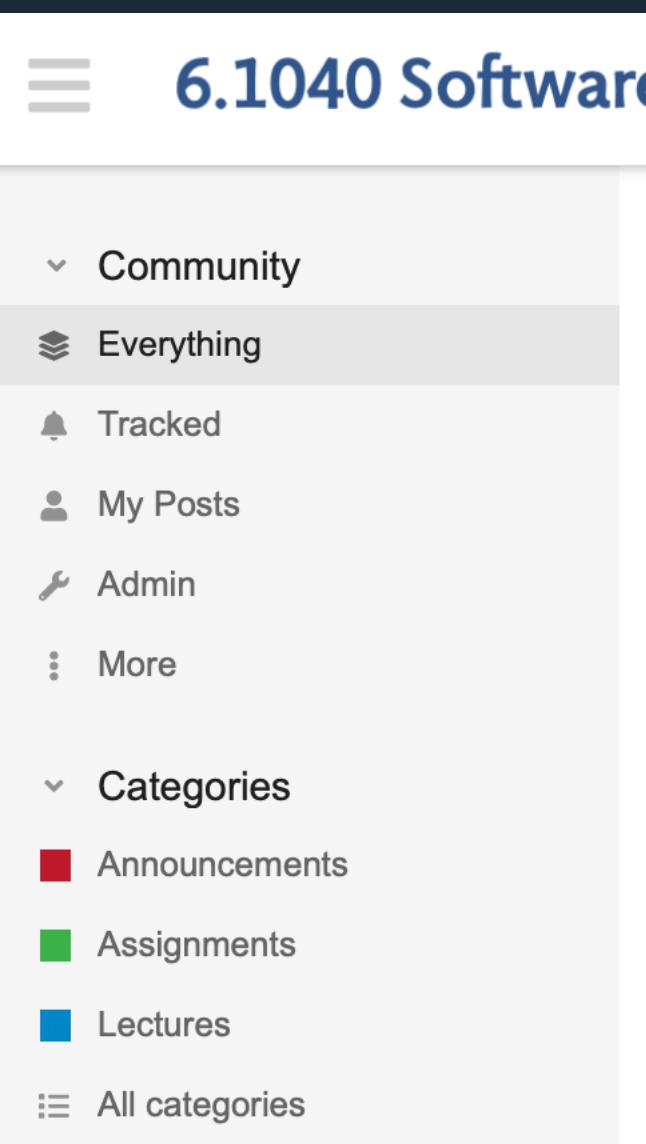
Process Event

- Stack Frame
- Stack Frame
- Stack Frame
- Stack Frame

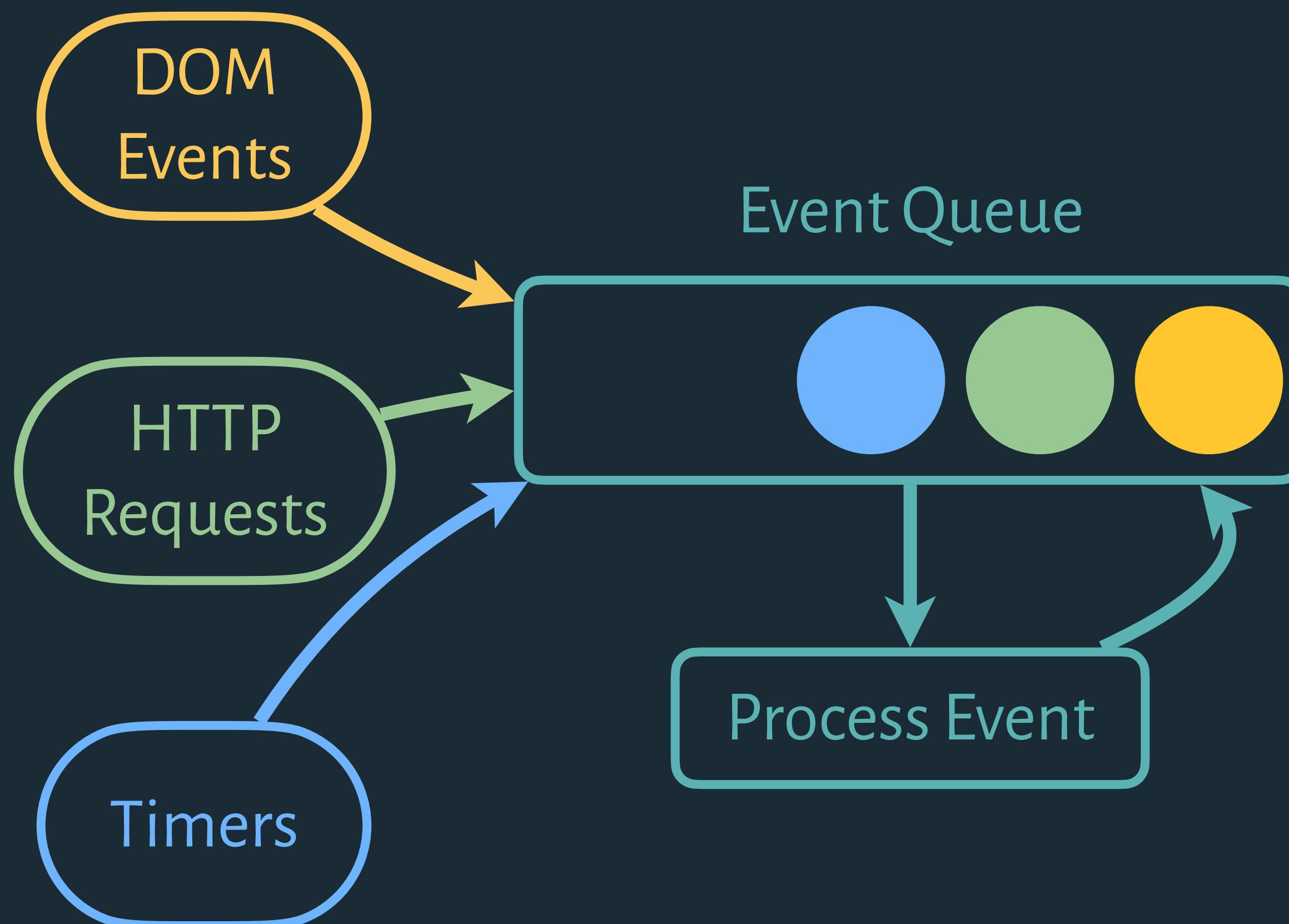
The JavaScript *Event Loop*

Call Stack

toggle.ts

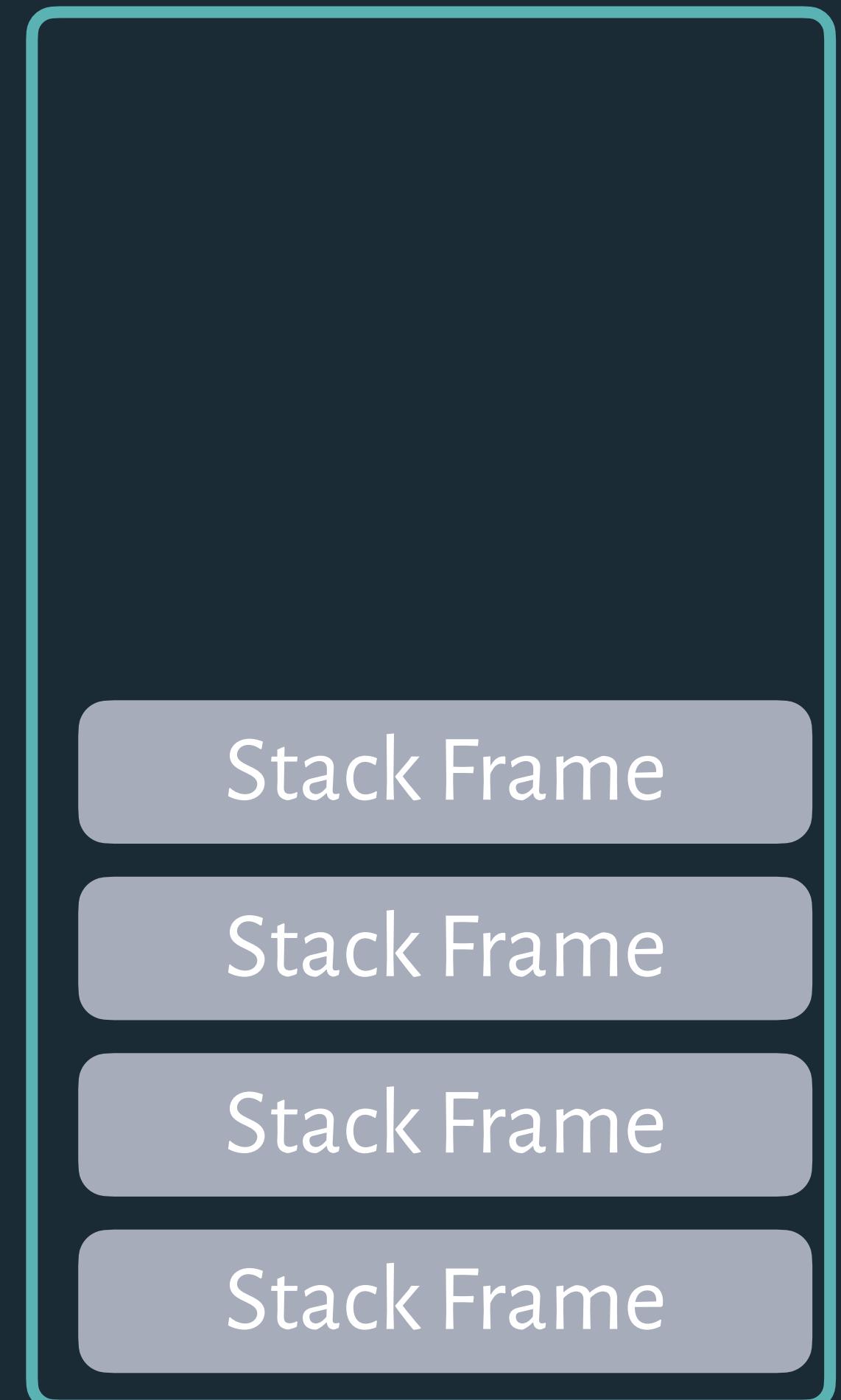
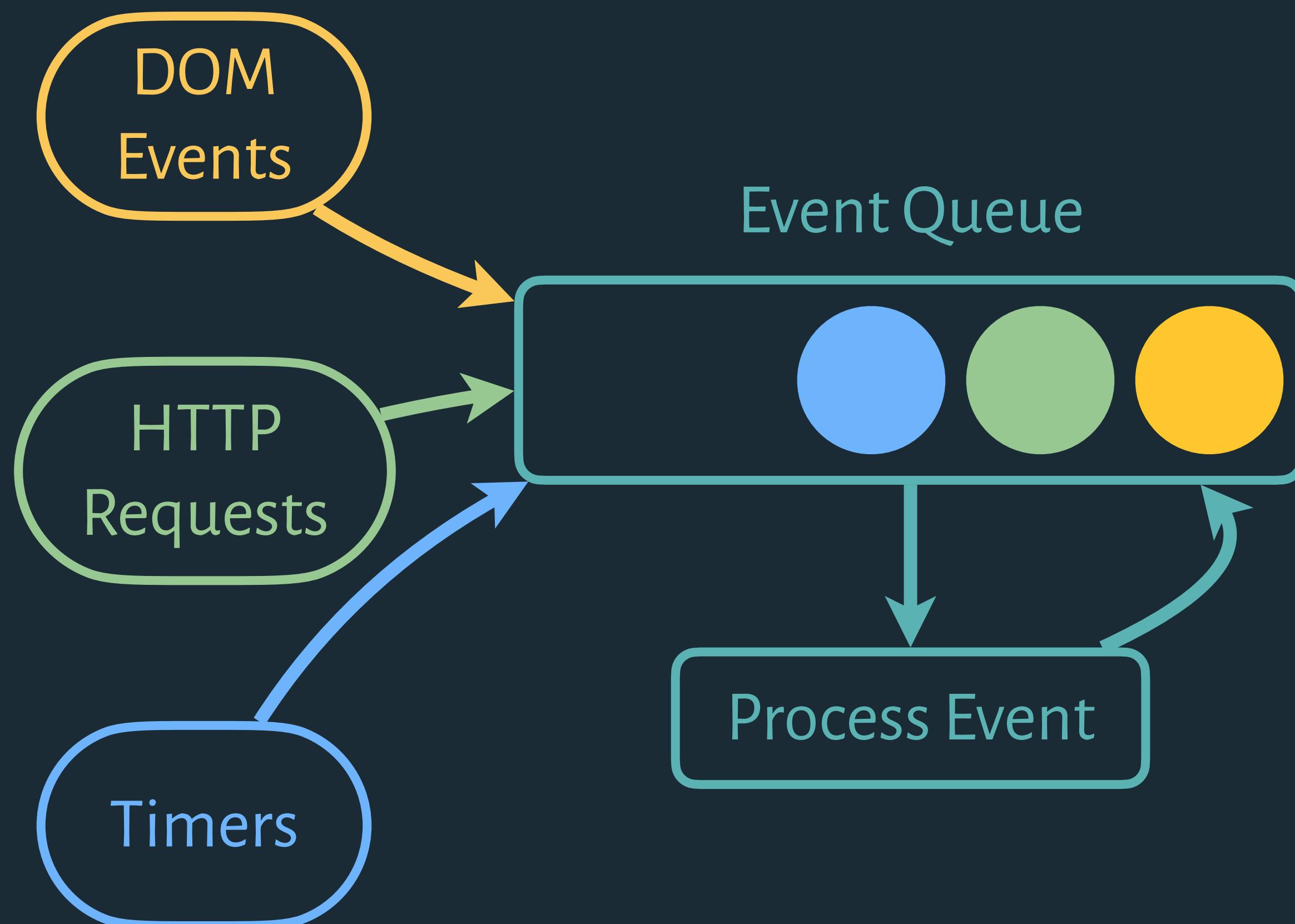
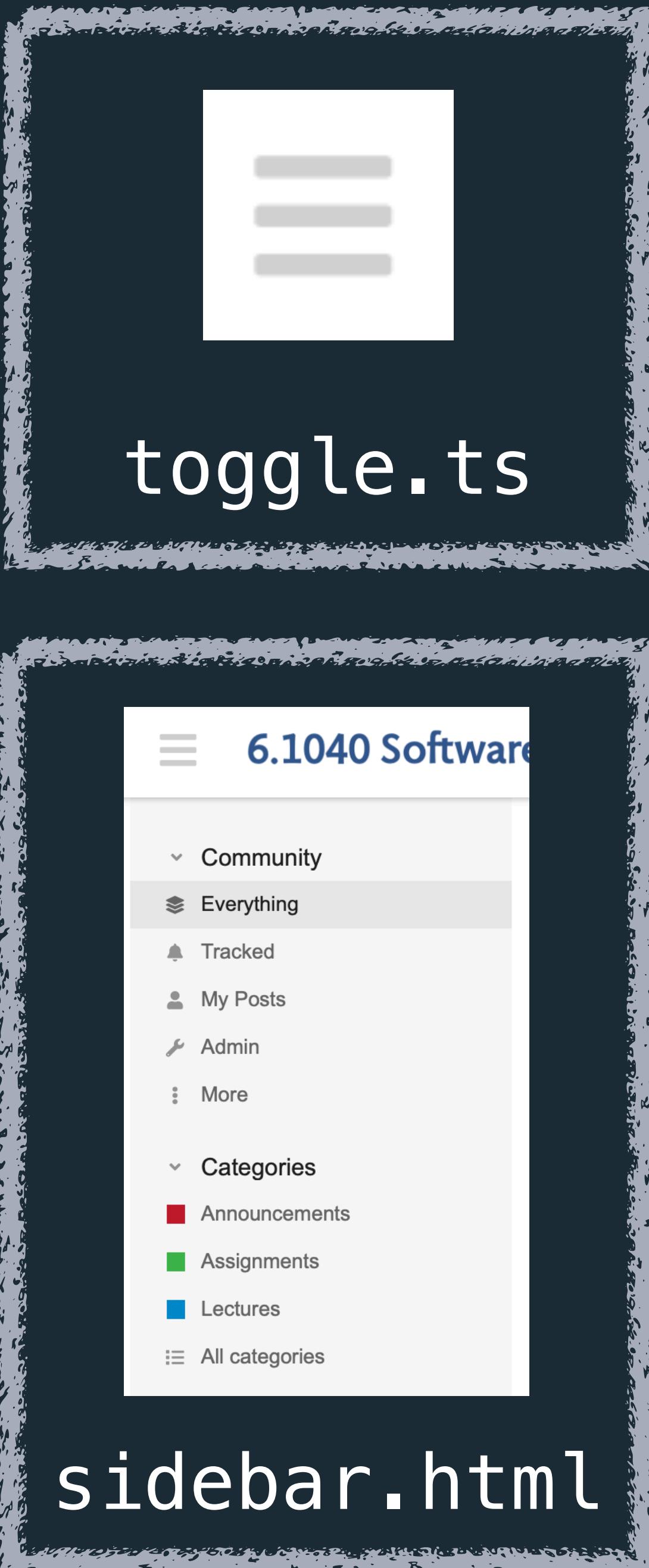


sidebar.html



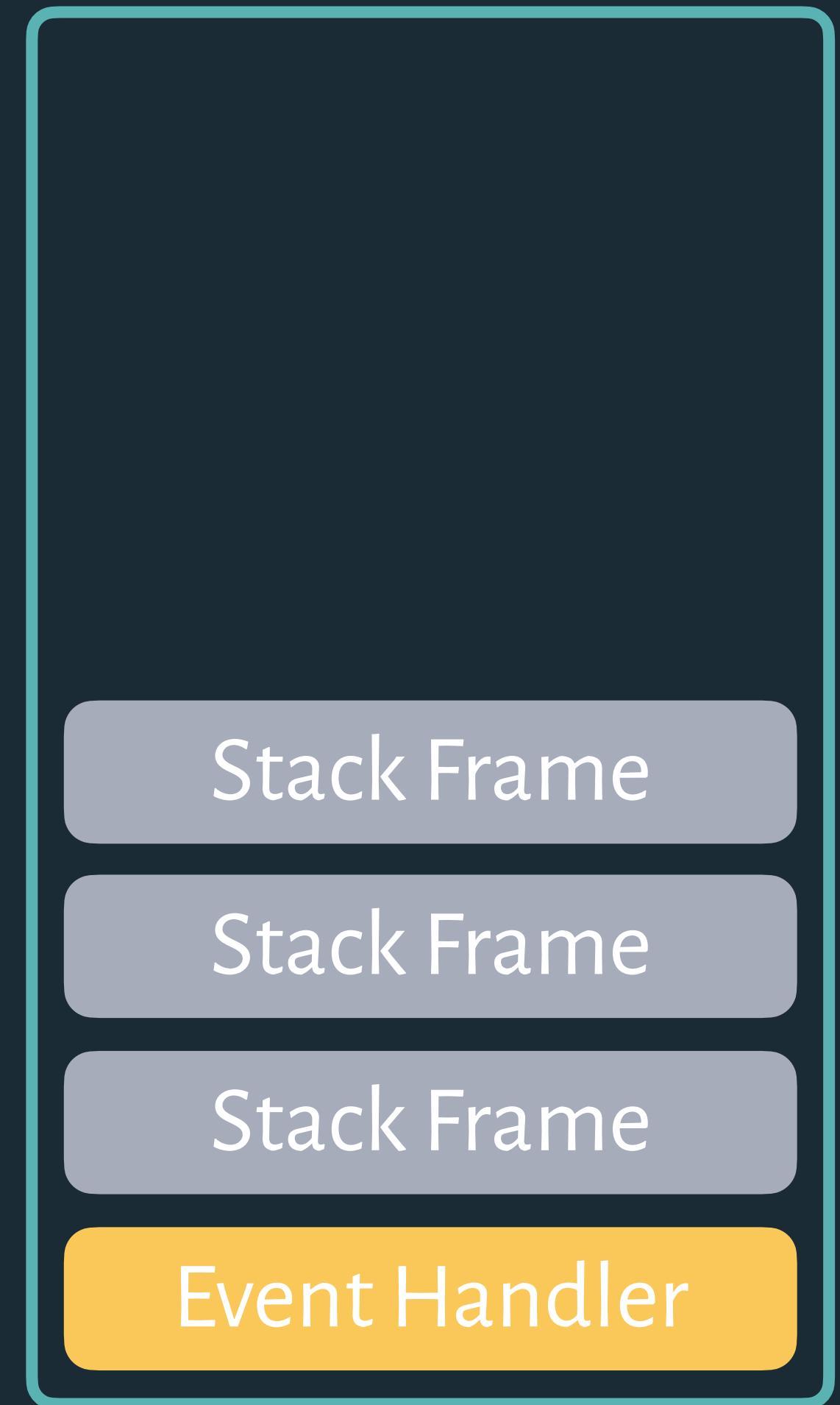
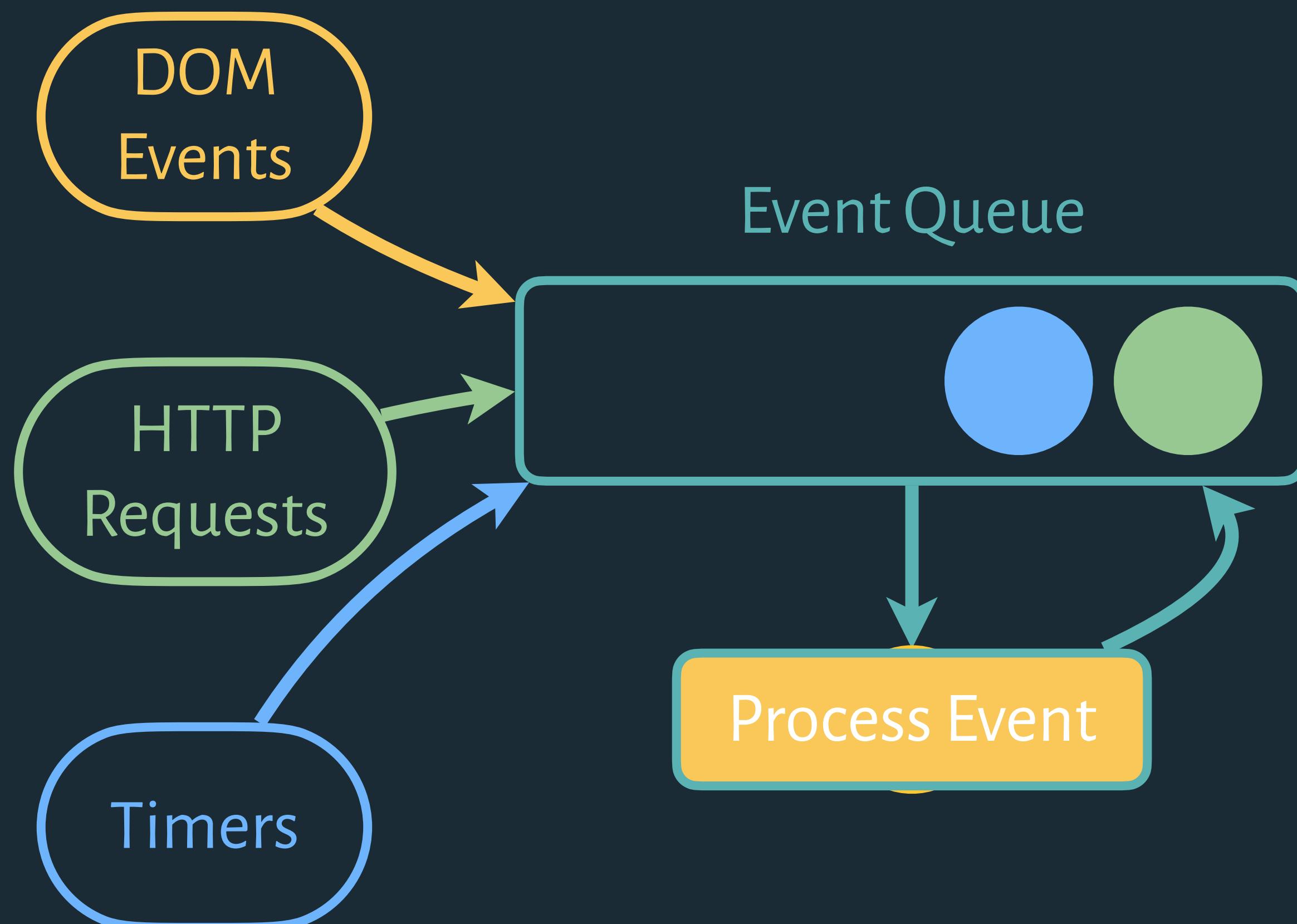
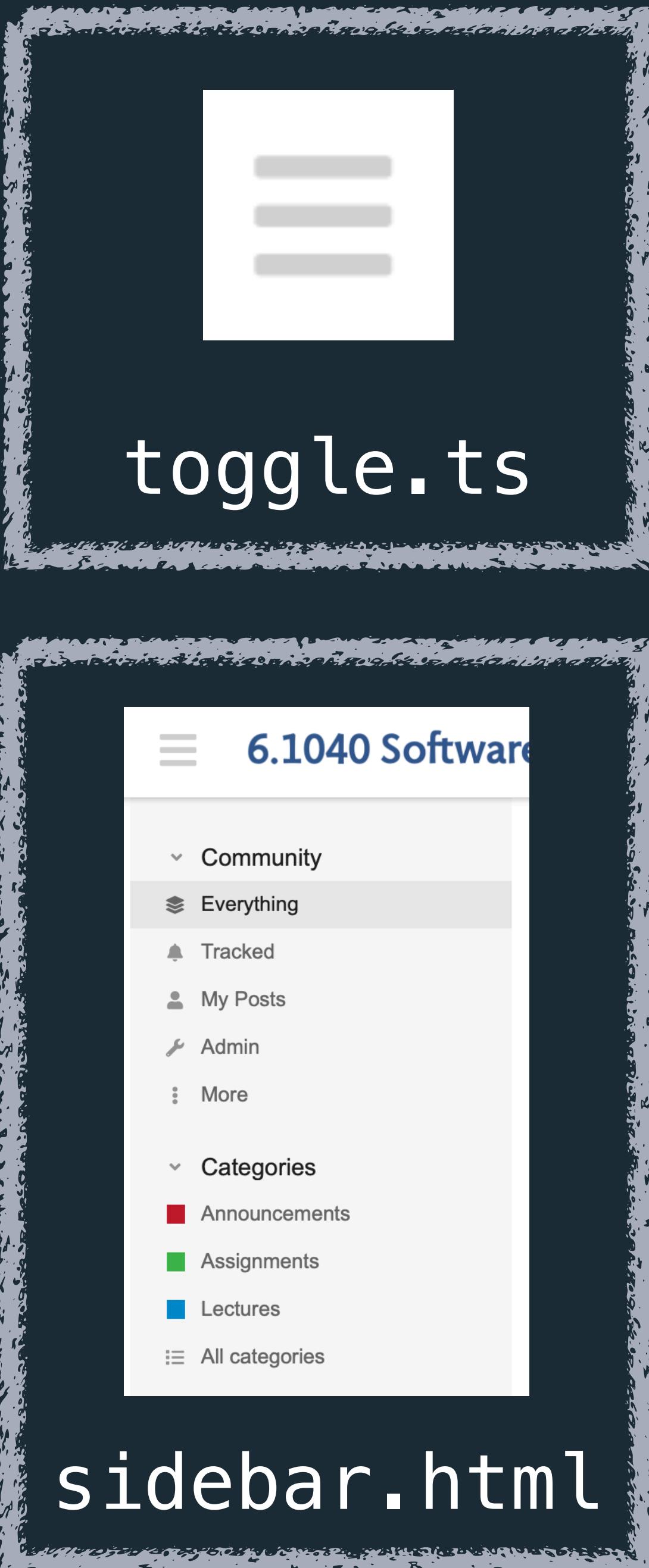
The JavaScript *Event Loop*

Call Stack



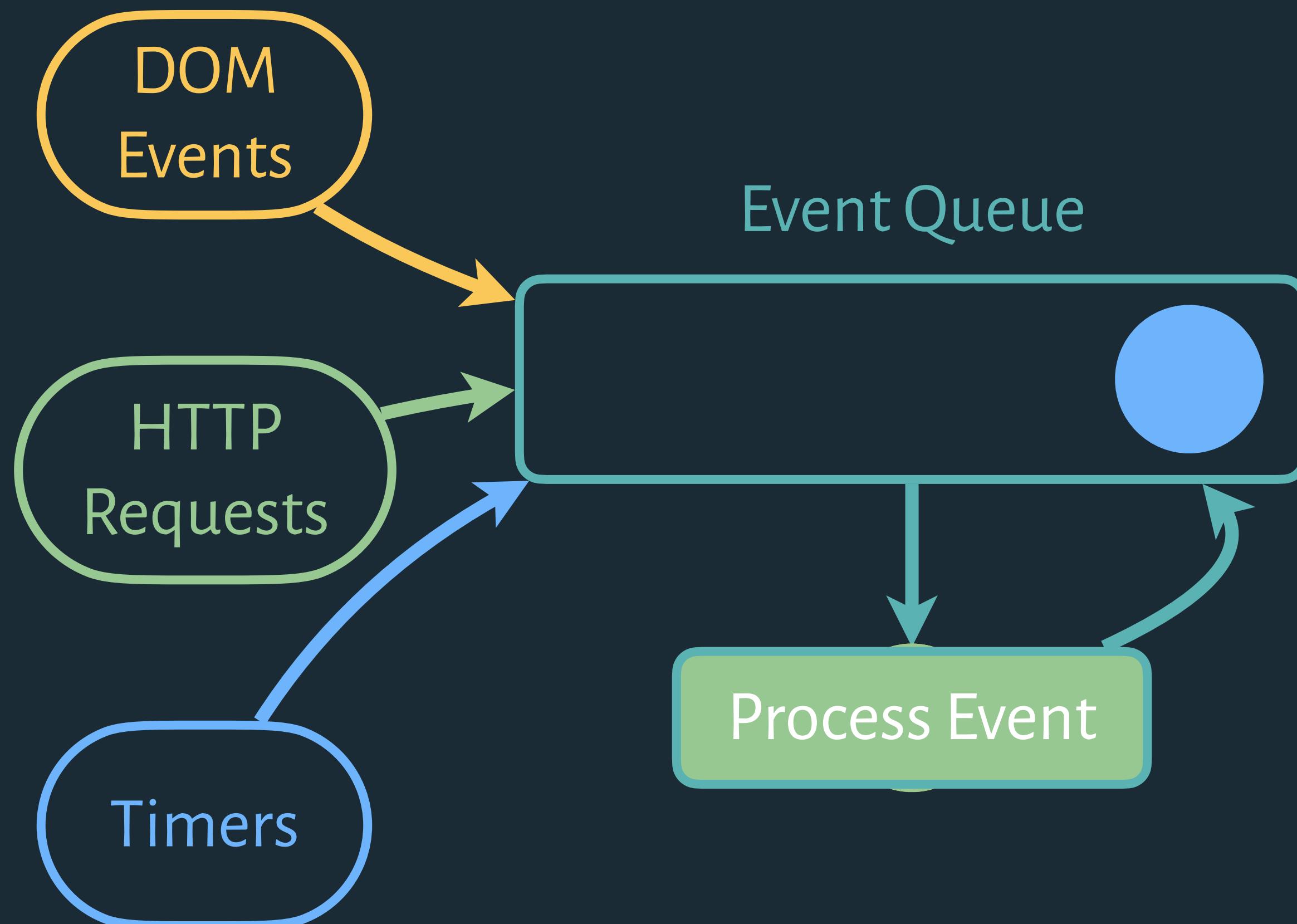
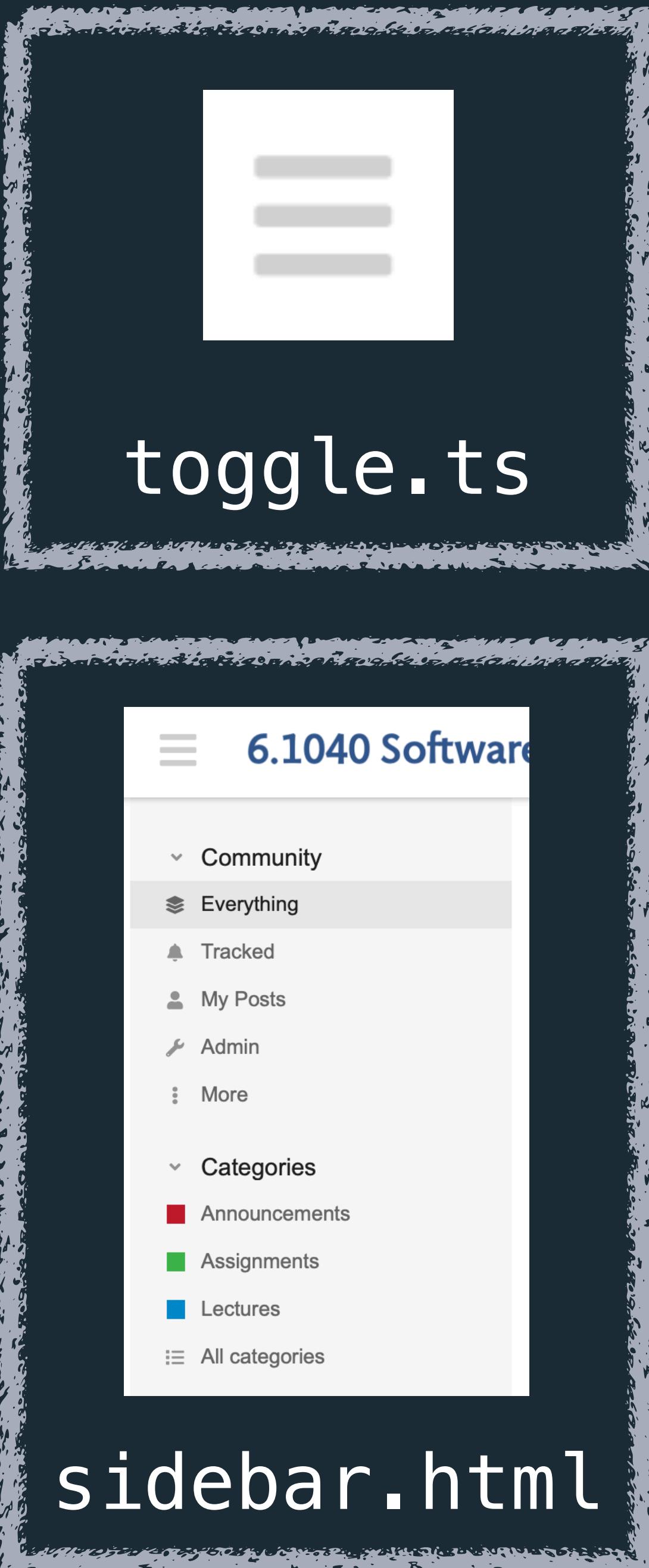
The JavaScript *Event Loop*

Call Stack



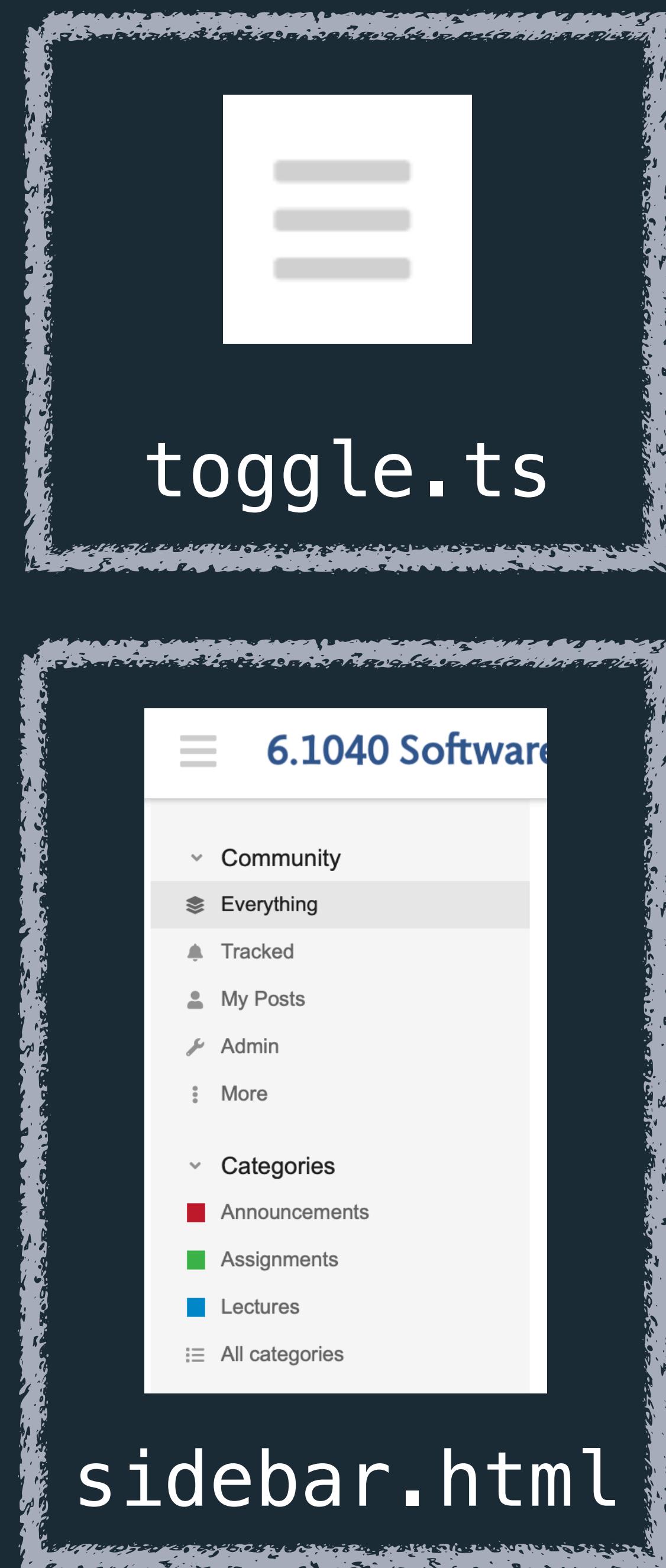
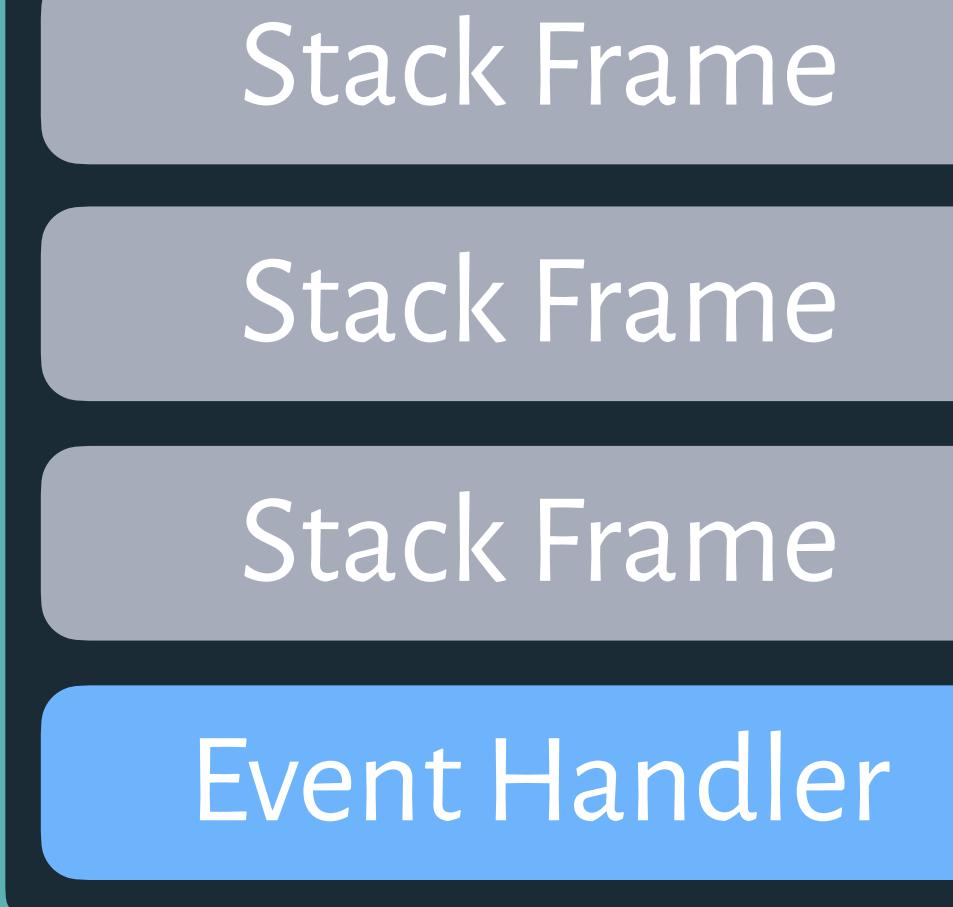
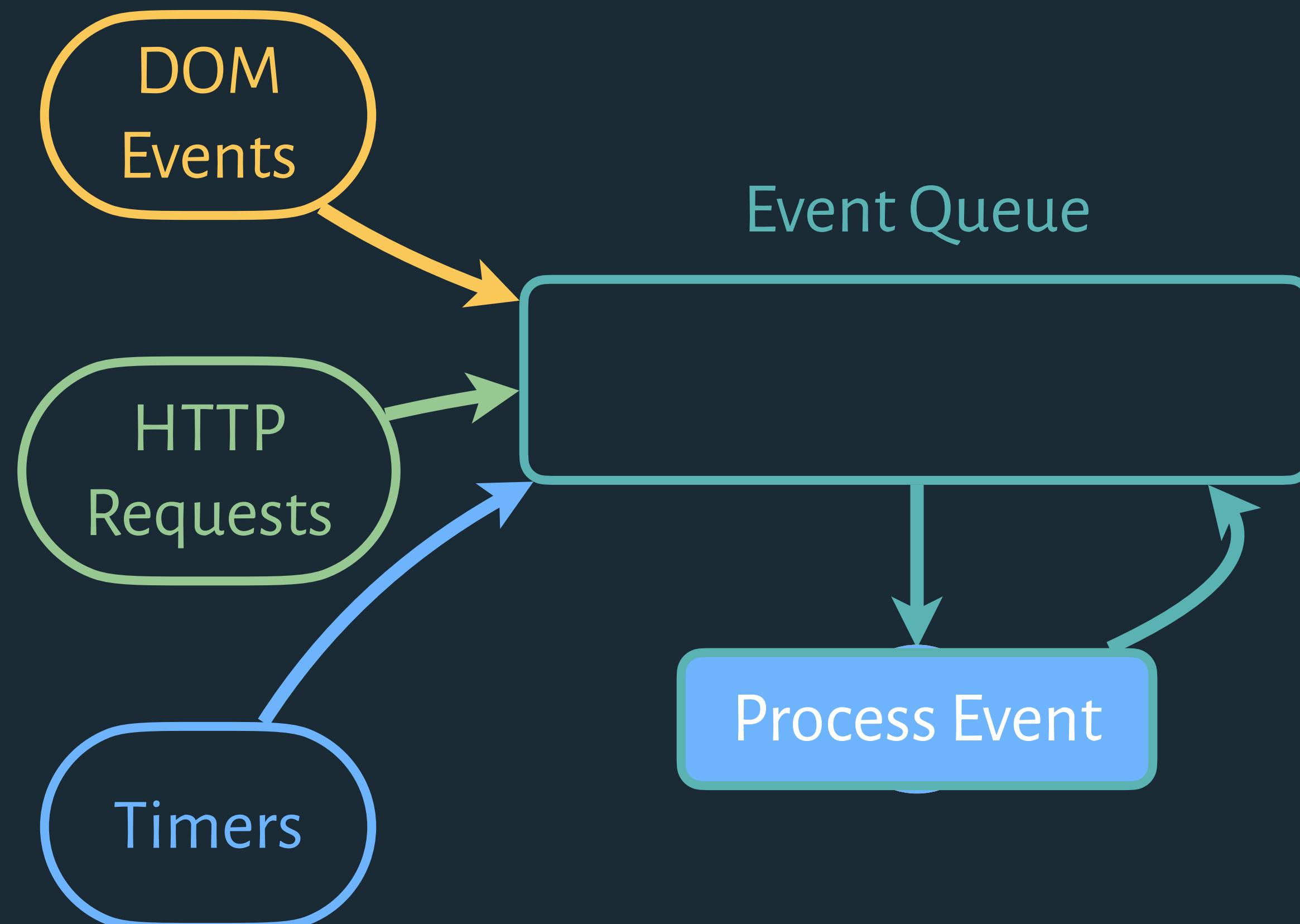
The JavaScript *Event Loop*

Call Stack



The JavaScript *Event Loop*

Call Stack

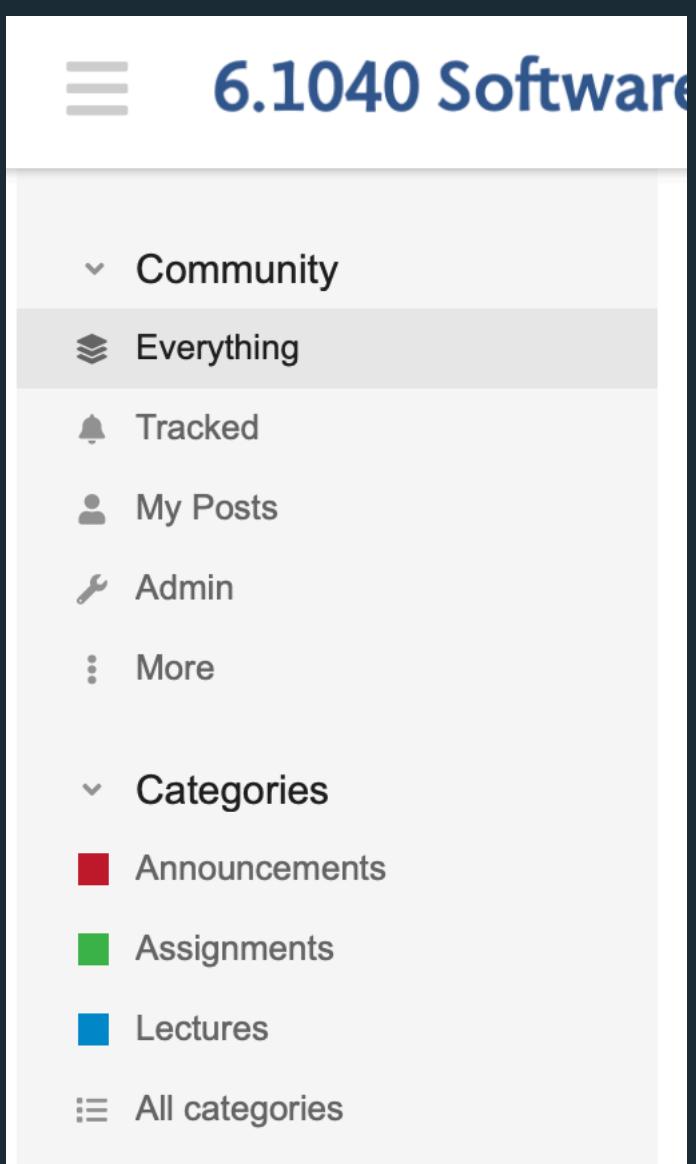




toggle.ts

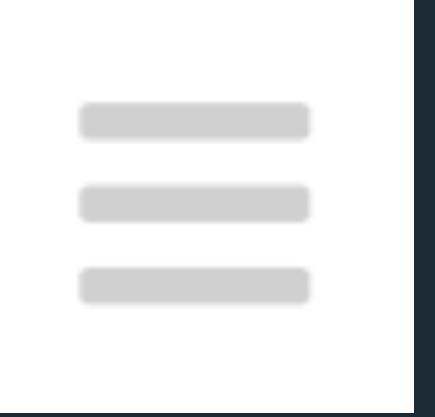
```
import {Sidebar} from './Sidebar.html';

Toggle.addEventListener('click', (event) => {
  const opacity = Sidebar.style.opacity;
  if (opacity === 0) Sidebar.style.opacity = 1;
  else Sidebar.style.opacity = 0;
});
```



sidebar.html

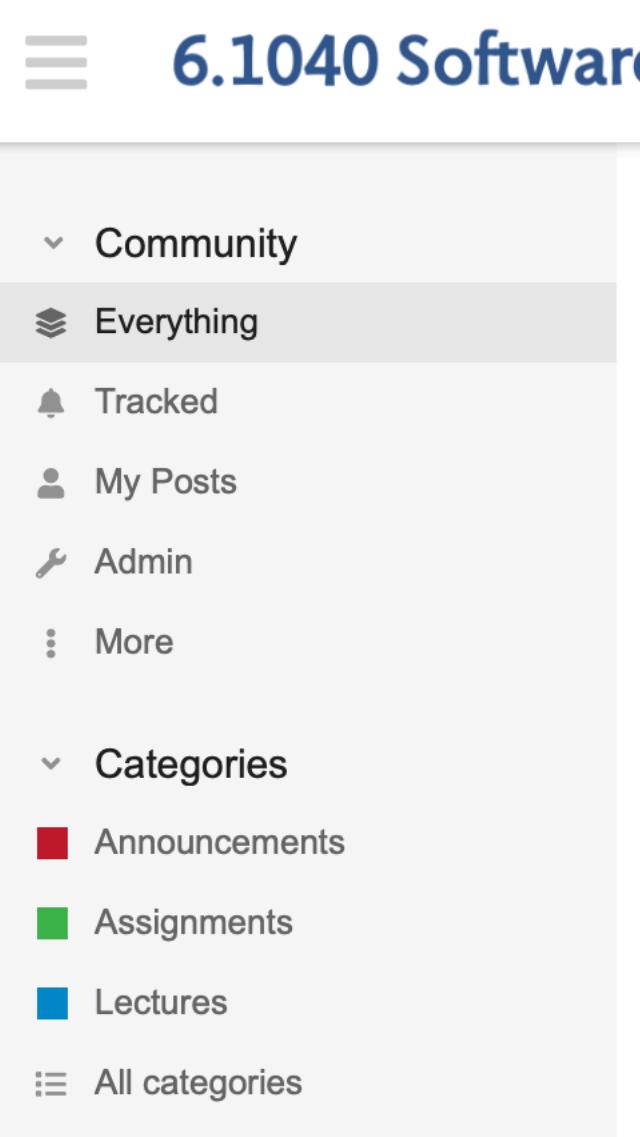
- ✖ Poor separation of concerns.
Neither toggle nor sidebar state is *well-encapsulated*.
Sidebar's state is being modified externally, and the Toggle button causes external effects (called "*side effects*").
- ✖ State is scattered across the app => makes debugging harder.



toggle.ts

```
import {Sidebar} from './Sidebar.html';

Toggle.addEventListener('click', (event) => {
  const opacity = Sidebar.style.opacity;
  if (opacity === 0) Sidebar.style.opacity = 1;
  else Sidebar.style.opacity = 0;
});
```

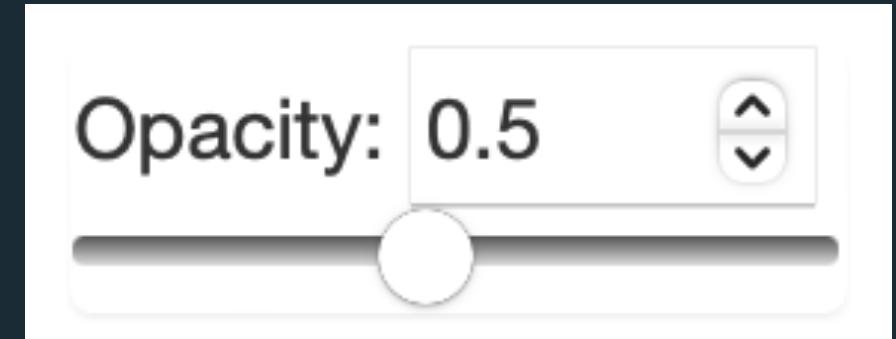


6.1040 Software

- Community
- Everything
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- My Posts
- Admin
- More

- Categories
 - Announcements
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- All categories

sidebar.html



widget.ts

```
import {Sidebar} from './Sidebar.html';

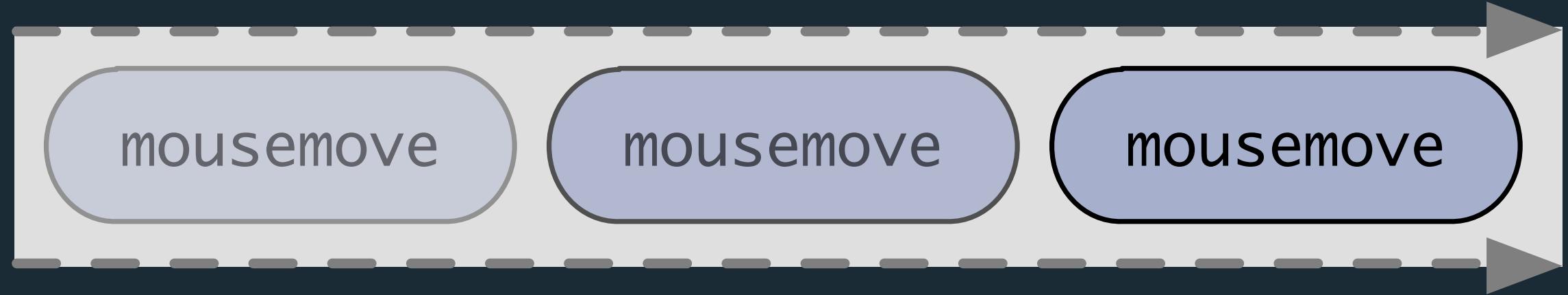
Textbox.addEventListener('change', () => {
  Sidebar.style.opacity = Textbox.value
  Slider.value = Textbox.value;
});

Slider.addEventListener('change', () => {
  Sidebar.style.opacity = Slider.value
  Textbox.value = Slider.value;
});
```

✖ Infinite loop between Textbox and Slider event handlers!

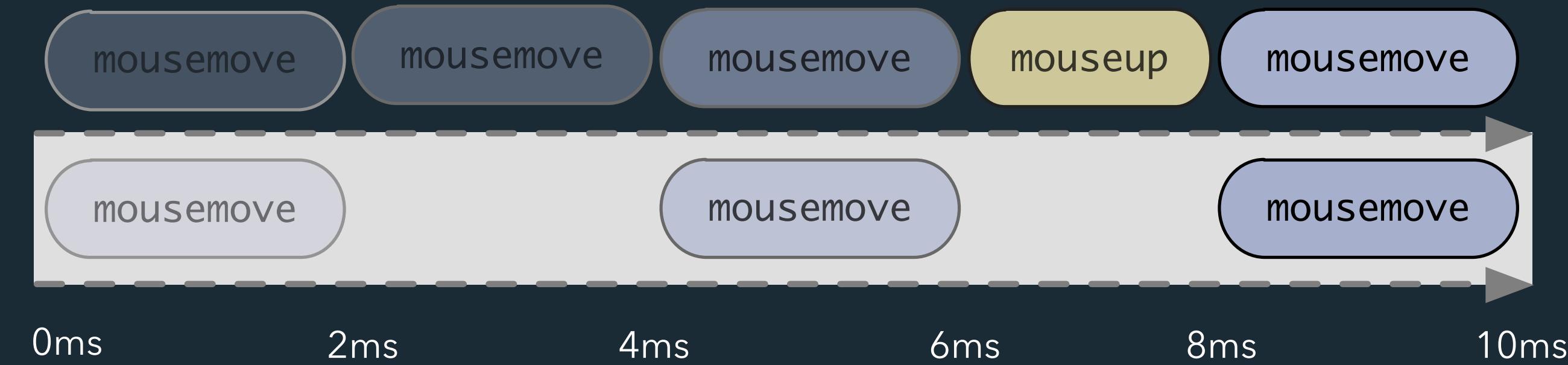
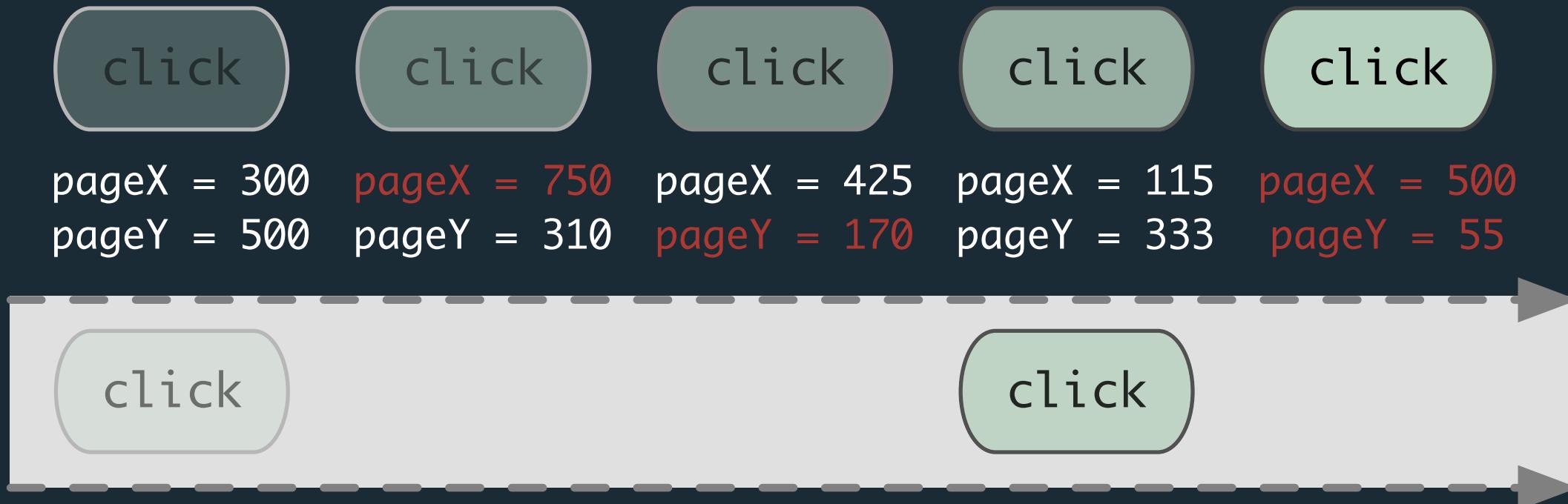
Reactive Programming

From *Event Listeners* to *Event Streams*



Event streams: an abstraction that treats events as a *continuous* data streams (rather than one-off occurrences that must be captured and handled ad hoc).

Operators on *Event Streams*

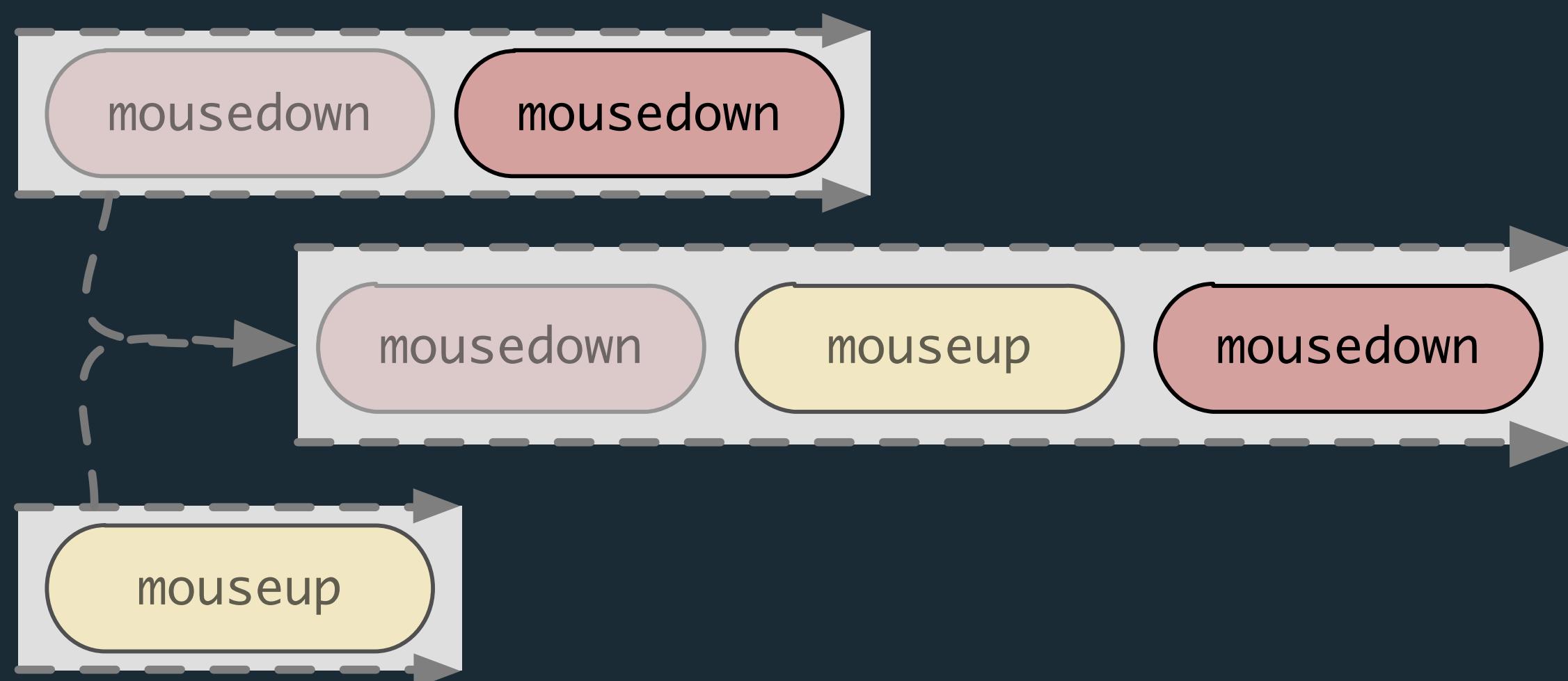


Filtering events out of streams based on their properties.

Debouncing or *throttling* the frequency of events in a stream.

Operators on *Event Streams*

Merging individual streams into a single stream with *interleaved* events.



Operators on *Event Streams*

```
let dragging = null;

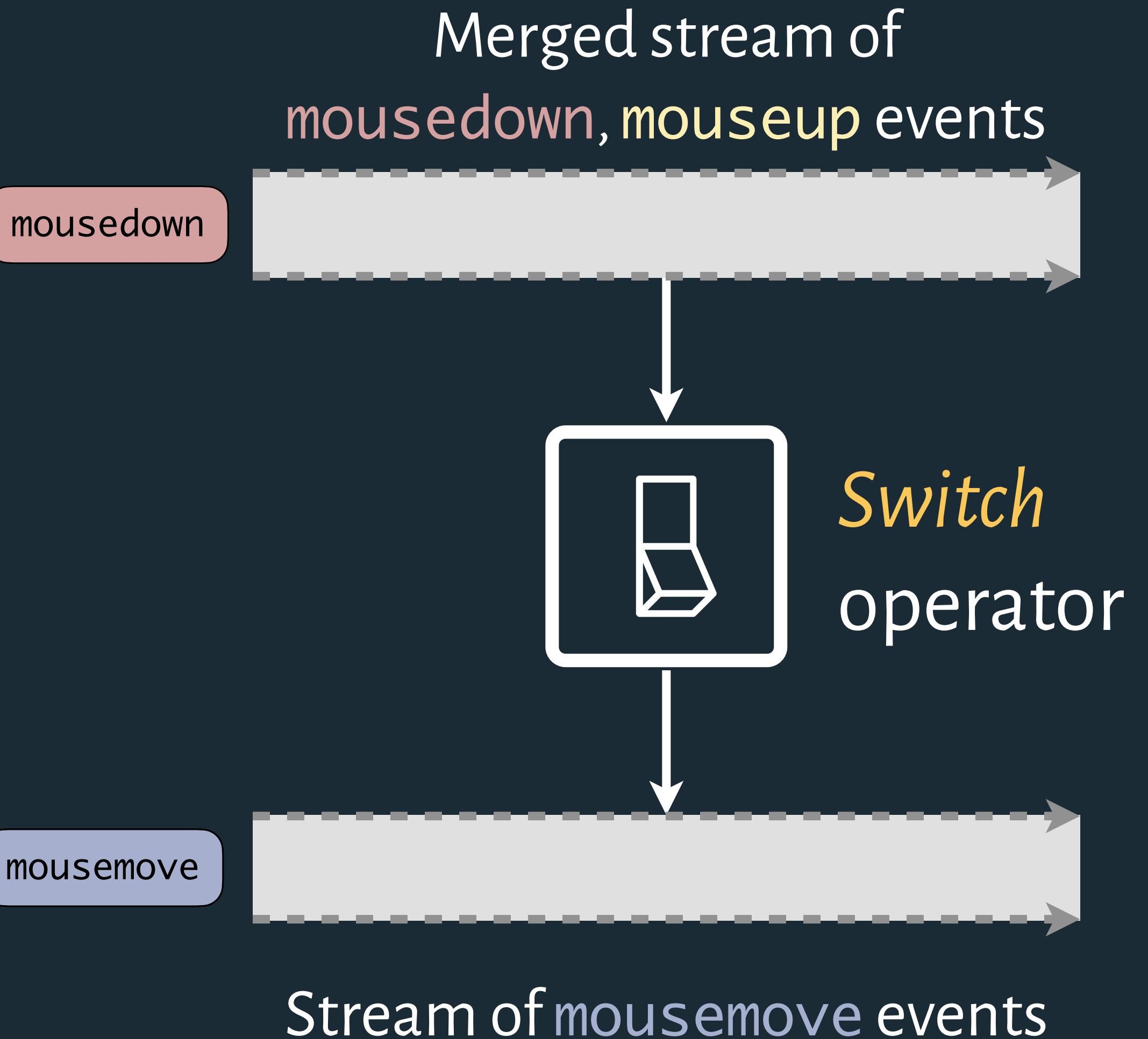
elem.addEventListener('mousedown', function(event) {
  dragging = elem;
});

window.addEventListener('mouseup', function(event) {
  dragging = null;
});

document.addEventListener('mousemove', function(event) {
  // absolute positioning
  dragging.style.left = event.pageX;
  dragging.style.top = event.pageY;
});
```

Operators on *Event Streams*

```
let dragging = null;  
  
elem.addEventListener('mousedown', function(event) {  
  dragging = elem;  
});  
  
window.addEventListener('mouseup', function(event) {  
  dragging = null;  
});  
  
document.addEventListener('mousemove', function(event) {  
  // absolute positioning  
  dragging.style.left = event.pageX;  
  dragging.style.top = event.pageY;  
});
```



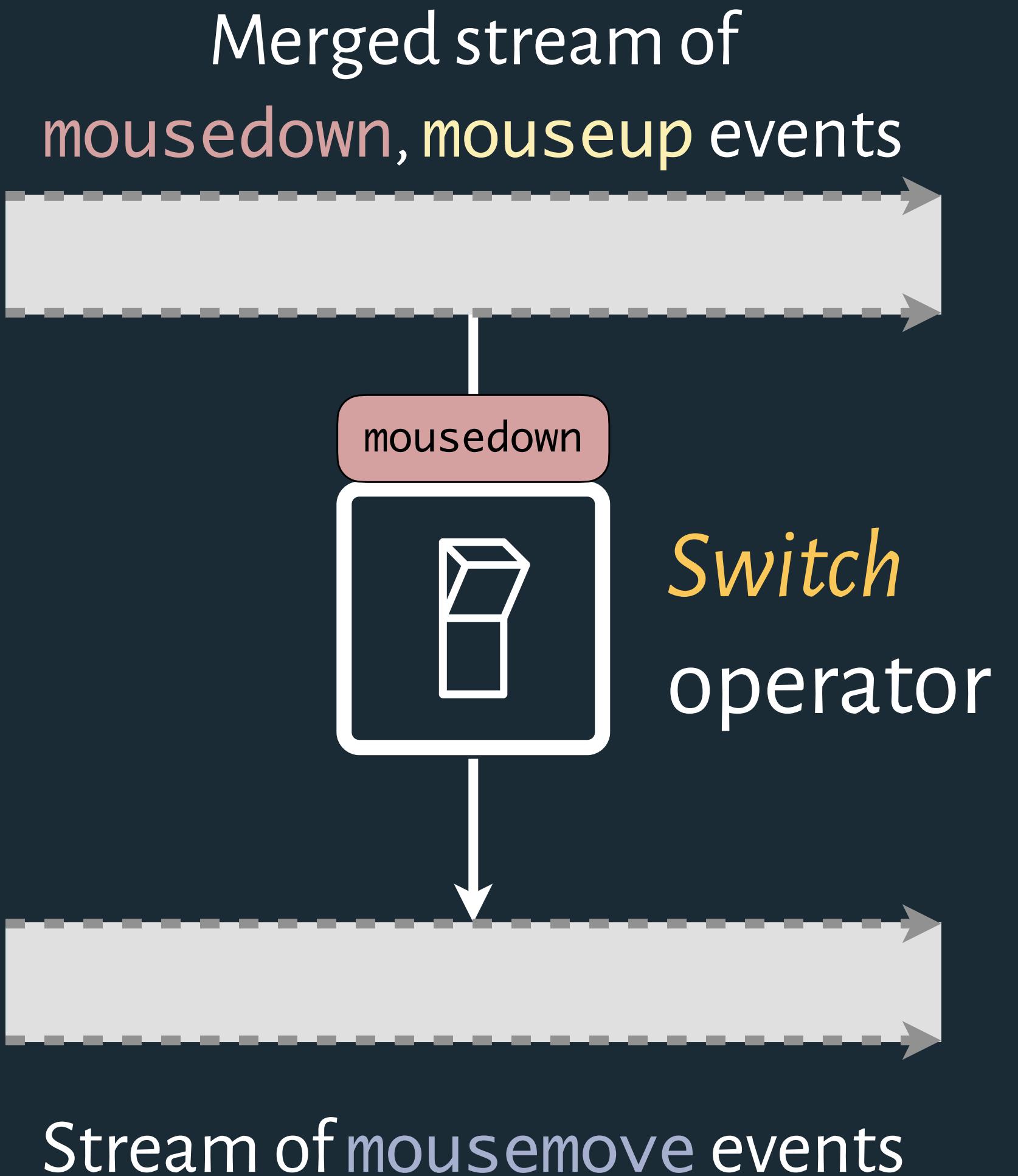
Operators on *Event Streams*

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  dragging.style.top = event.pageY;
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```



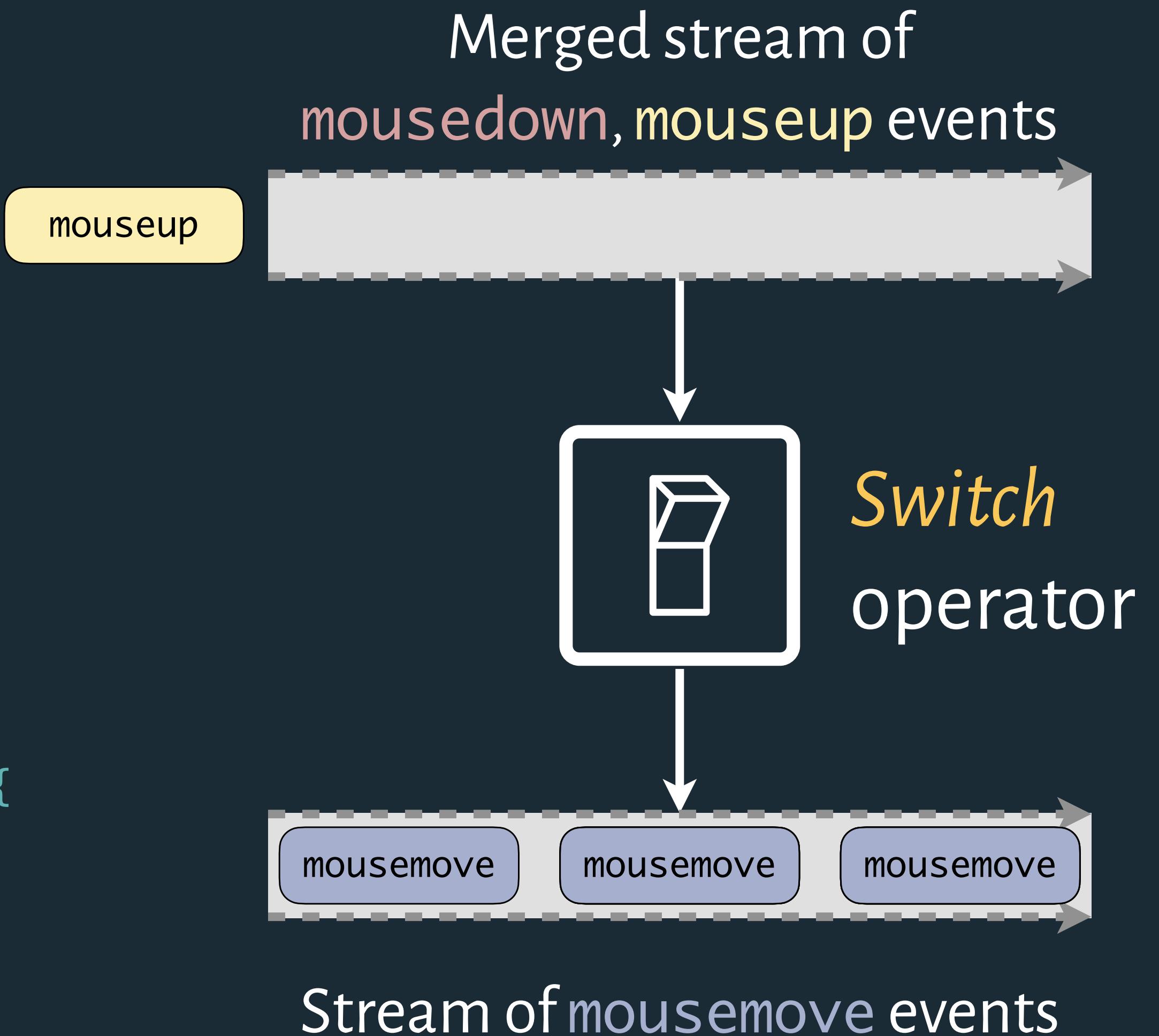
Operators on *Event Streams*

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```



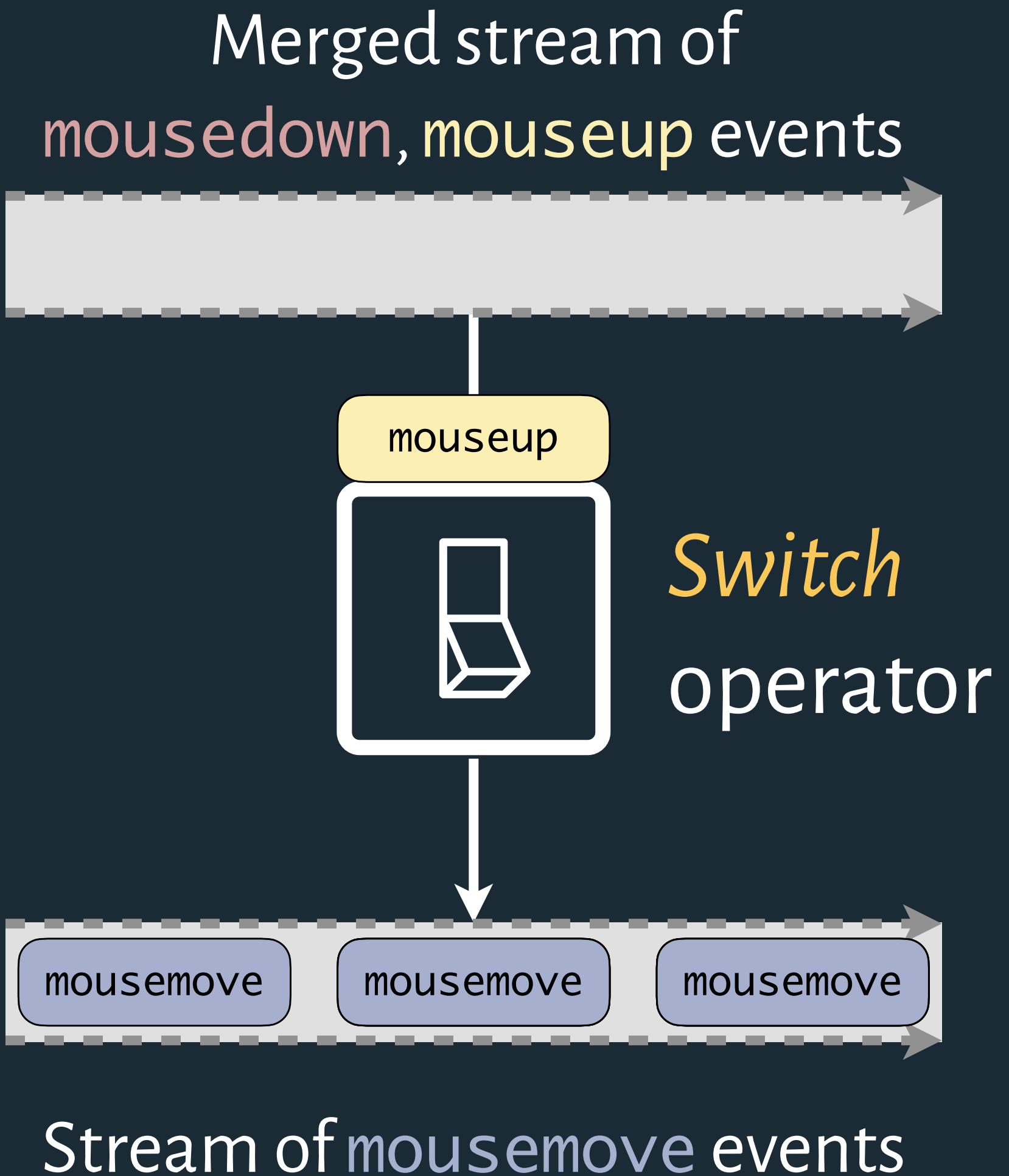
Operators on *Event Streams*

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let dragging = null;

elem.addEventListener('mousedown', function(event) {
  dragging = elem;
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window.addEventListener('mouseup', function(event) {
  dragging = null;
});

document.addEventListener('mousemove', function(event) {
  // absolute positioning
  dragging.style.left = event.pageX;
  dragging.style.top = event.pageY;
});
```



In practice, few libraries expose event streams directly.

Instead, event streams are constructed in the background, and their most recent values are available as *reactive variables*.

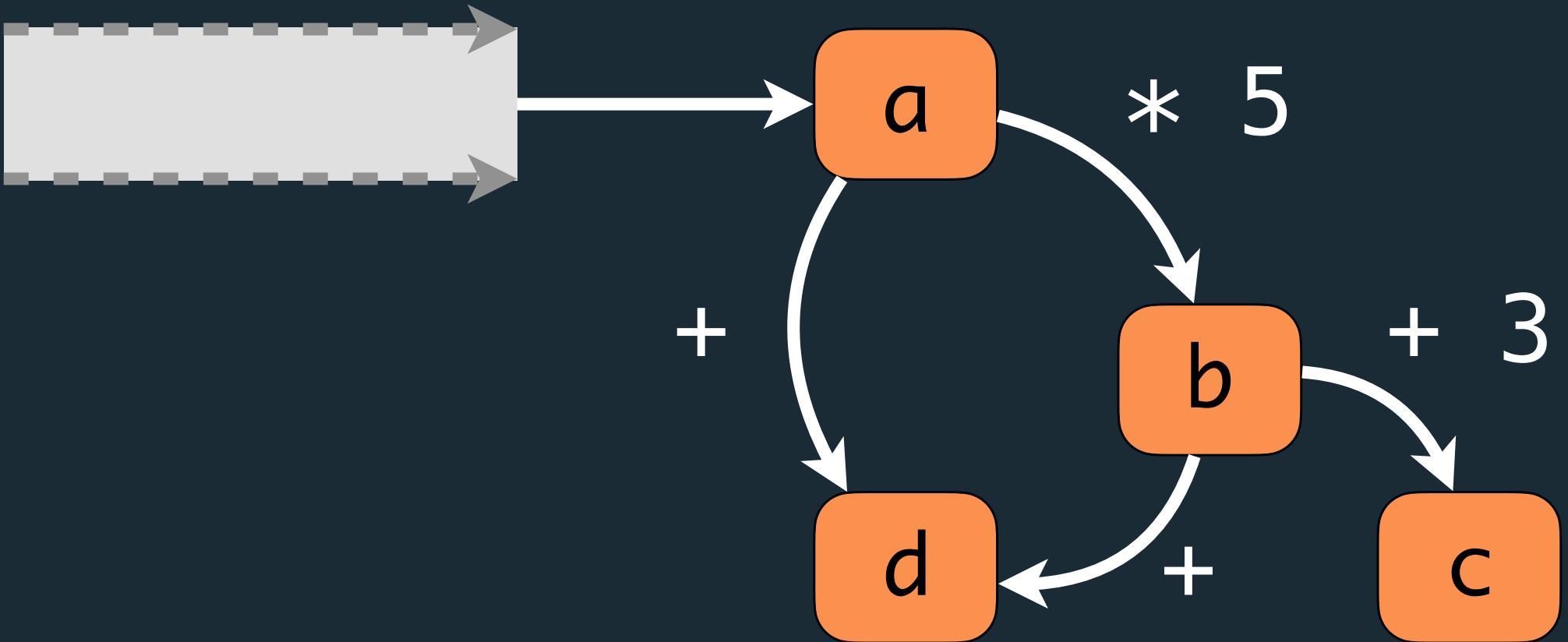
fx

	A	B	C	M	N	O	P	Q
1								
2								
45	Expenses			Oct	Nov	Dec	Total	Average
46	<i>Everyday</i>	Monthly totals:	\$0	\$0	\$0	\$0	\$0	\$0
47		Groceries					\$0	\$0
48		Restaurants					\$0	\$0
49		Entertainment					\$0	\$0
		Clothes					\$0	\$0

Reactive Programming is *Dataflow Programming*

```
a; <-- data streams in  
b = a * 5;  
c = b + 3;  
d = a + b;
```

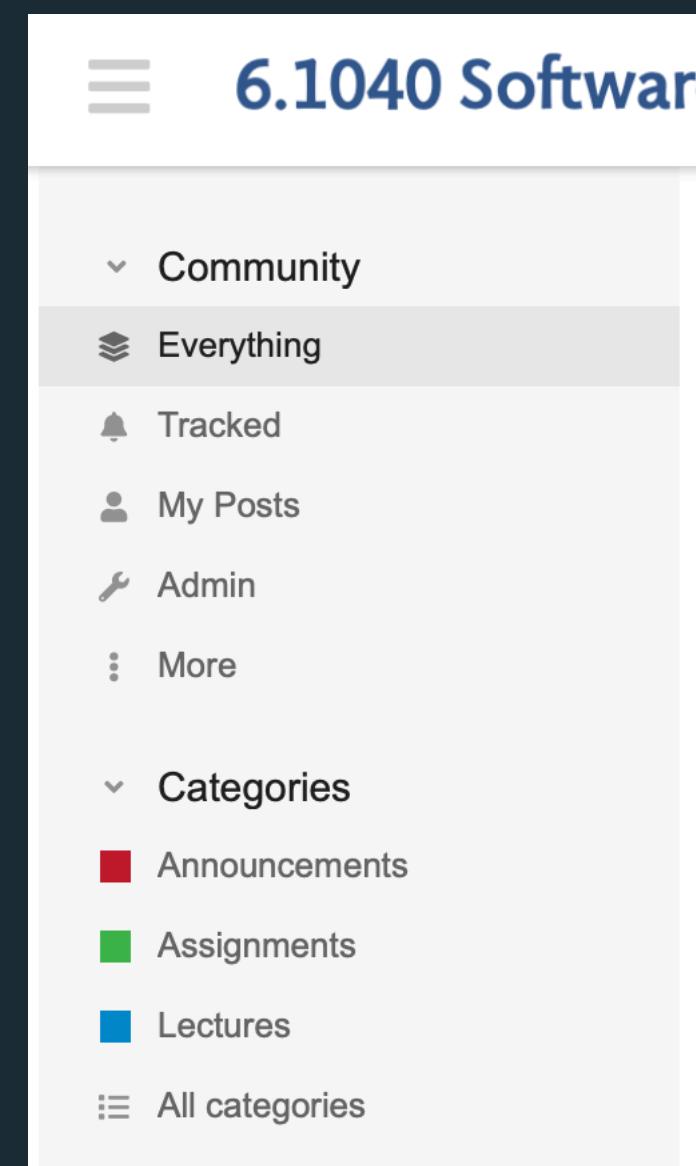
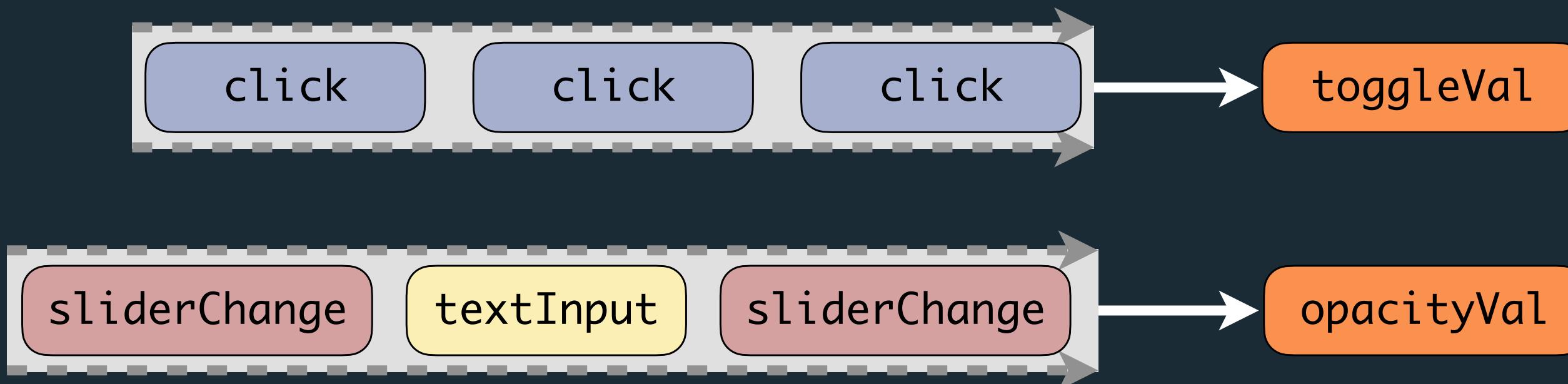
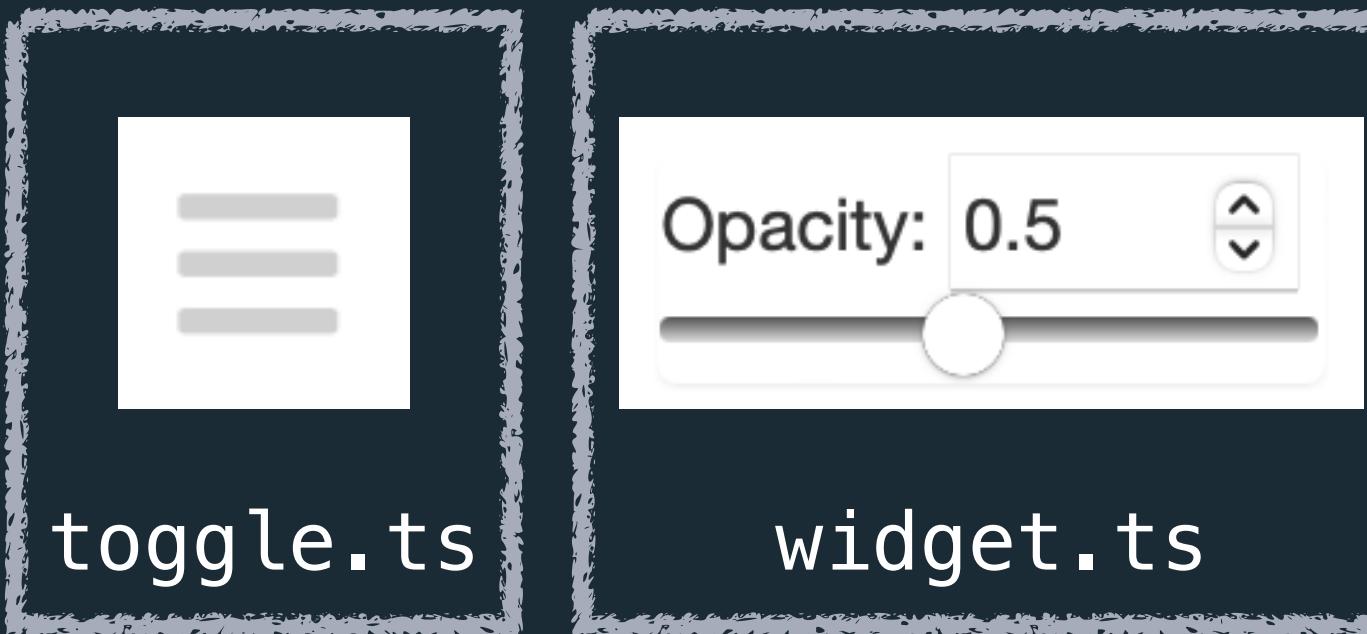
pseudo-code



When new data streams in, **a** is automatically updated, and its new value propagates to variables that depend on it (**b**, **d**).

These variables update, and their values continue forwards (**b** → **c**).

Updates are *topologically sorted*: a variable is only updated once *all* of its dependencies have been updated.



sidebar.html

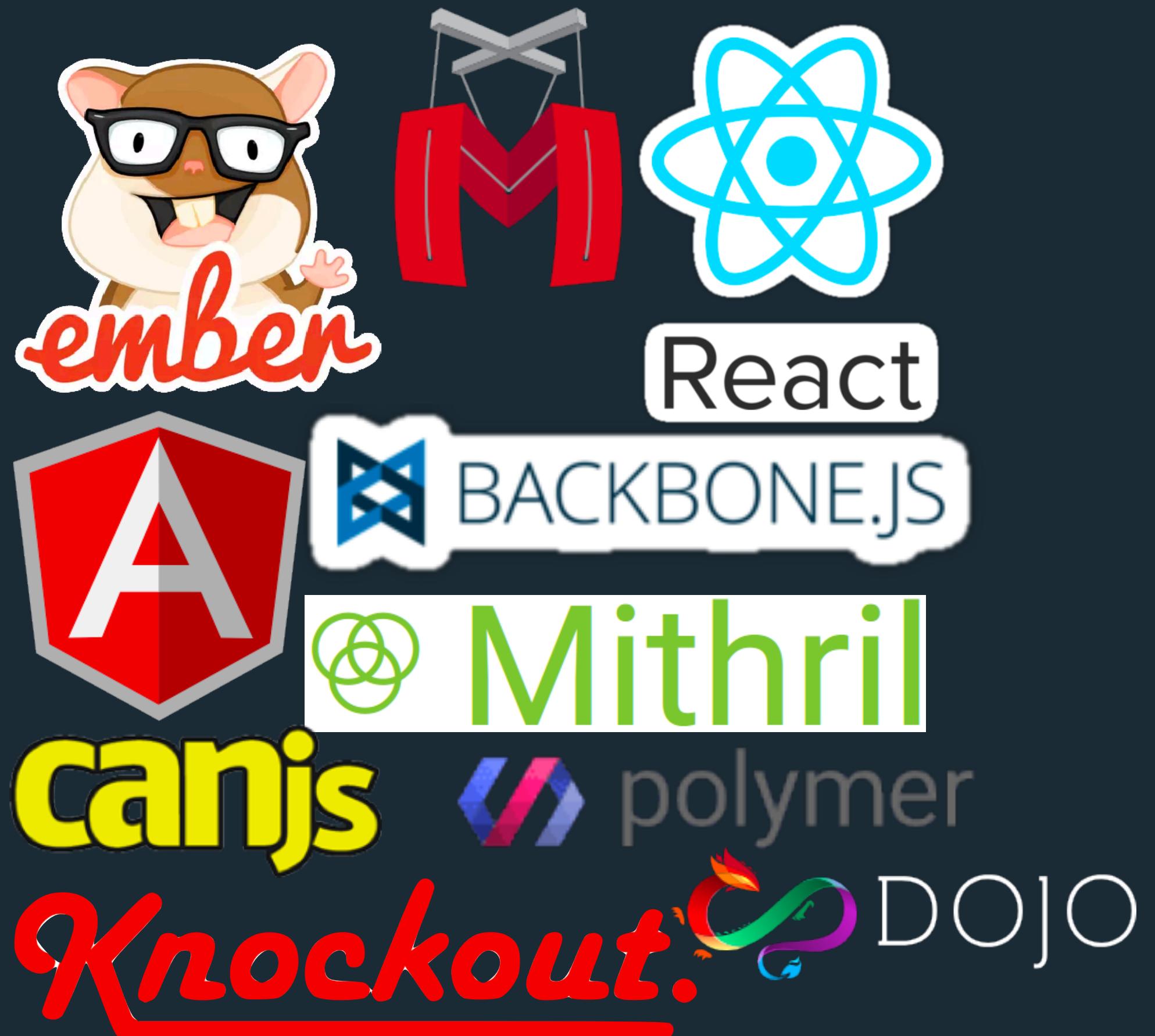
```

import {toggleVal} from './Toggle.ts'
import {opacityVal} from './Widget.ts'

Sidebar.style.opacity = (toggleVal, opacityVal) => {
  if (toggleVal === 0) return 0;
  else return opacityVal;
}
  
```

✓ Sidebar state is now well encapsulated.

✓ Much clearer insight into what this state depends on.



https://hackernoon.com/how-it-feels-to-learn... Follow Sign in Get started

Jose Aguinaga Follow
Web Engineer. Previously @numbrs, @plaidhq, @getflynt, currently @MyBit_DApp. Javascript, #people, startups, fintech, privacy, blockchain.
Oct 3, 2016 · 13 min read

How it feels to learn JavaScript in 2016

Cool. I need to create a page that displays the latest activity from the users, so I just need to get the data from the REST endpoint and display it in some sort of filterable table, and update it if anything changes in the server. I was thinking maybe using jQuery to fetch and display the data?

-Oh my god no, no one uses jQuery anymore. You should try learning React, it's 2016.

Oh, OK. What's React?

-It's a super cool library made by some guys at Facebook, it really brings control and performance to your application, by allowing you to handle any view changes very easily.

That sounds neat. Can I use React to display data from the server?

-Yeah, but first you need to add React and React DOM as a library in your webpage.

Wait, why two libraries?

-So one is the actual library and the second one is for manipulating the DOM, which now you can describe in JSX.

JSX? What is JSX?

-JSX is just a JavaScript syntax extension that looks pretty much like XML. It's kind of another way to describe the DOM, think of it as a better HTML.

What's wrong with HTML?

-It's 2016. No one codes HTML directly anymore.

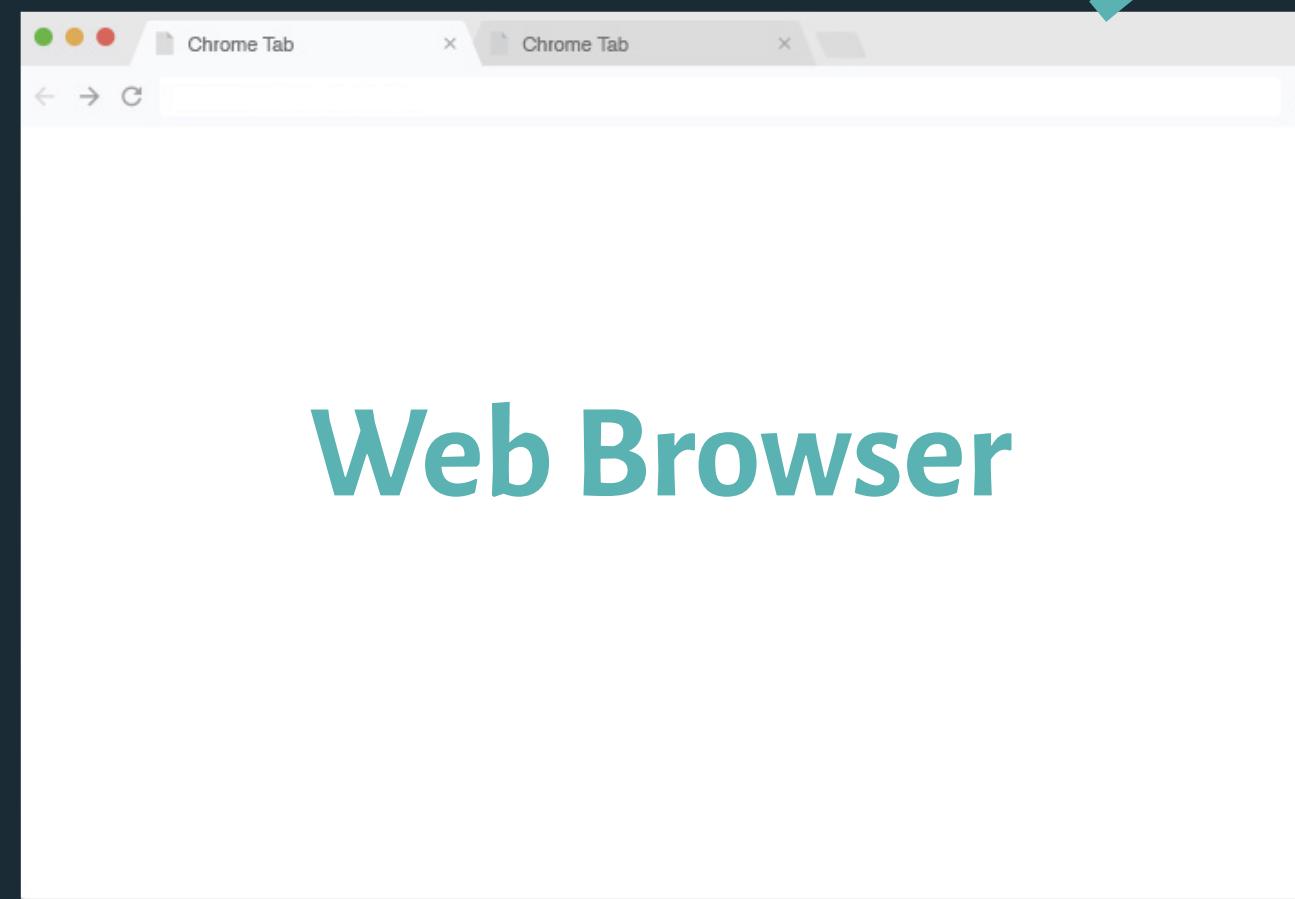


vue.js

- ✓ Small surface area (i.e., fewer new things to learn).
- ✓ Thriving ecosystem + community (i.e., easy to find help).

Note: We are use Vue v2, not v3.

Client Side



Server Side

HTTP Request

HTTP Response
(Full HTML page)

Routes

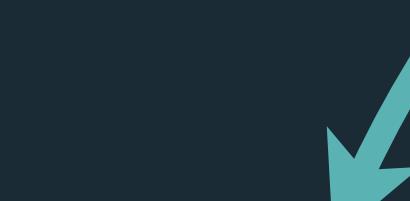
Templates

CRUD
Manipulation

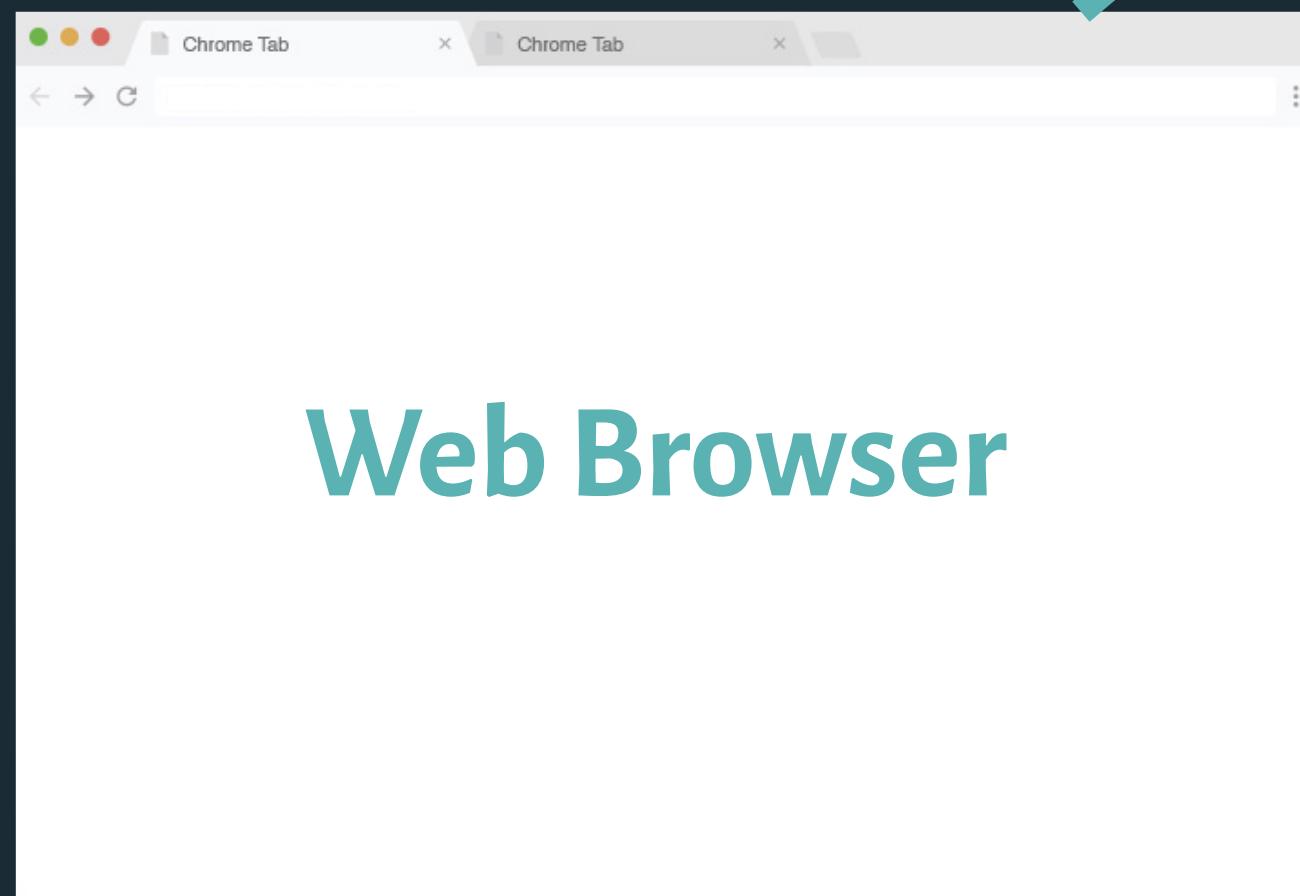
Data



Render



Client Side



Web Browser

Server Side

HTTP Request

HTTP Response
(Full HTML page)

Controller
(Routes)

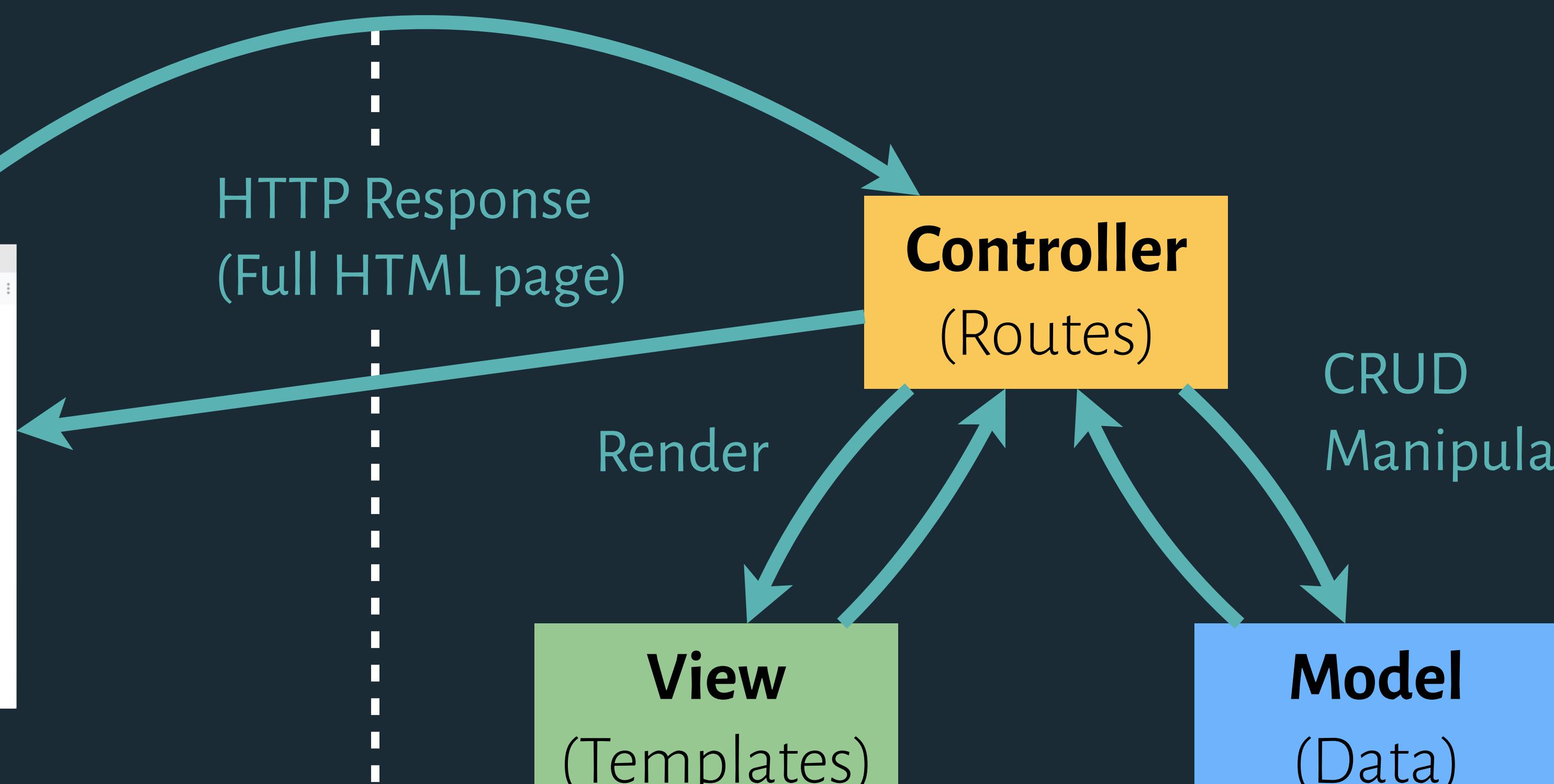
Render

View
(Templates)

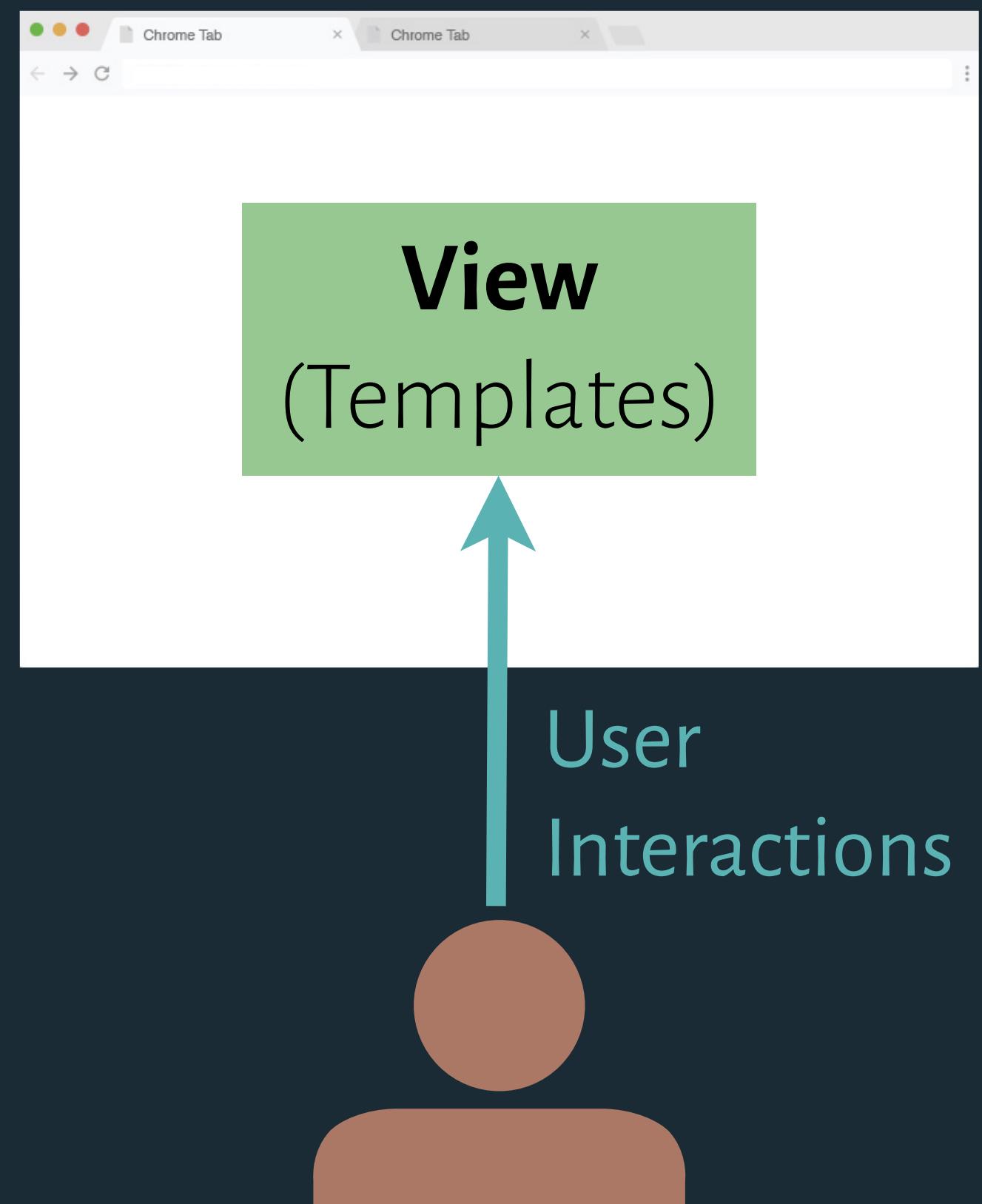
CRUD
Manipulation

Model
(Data)

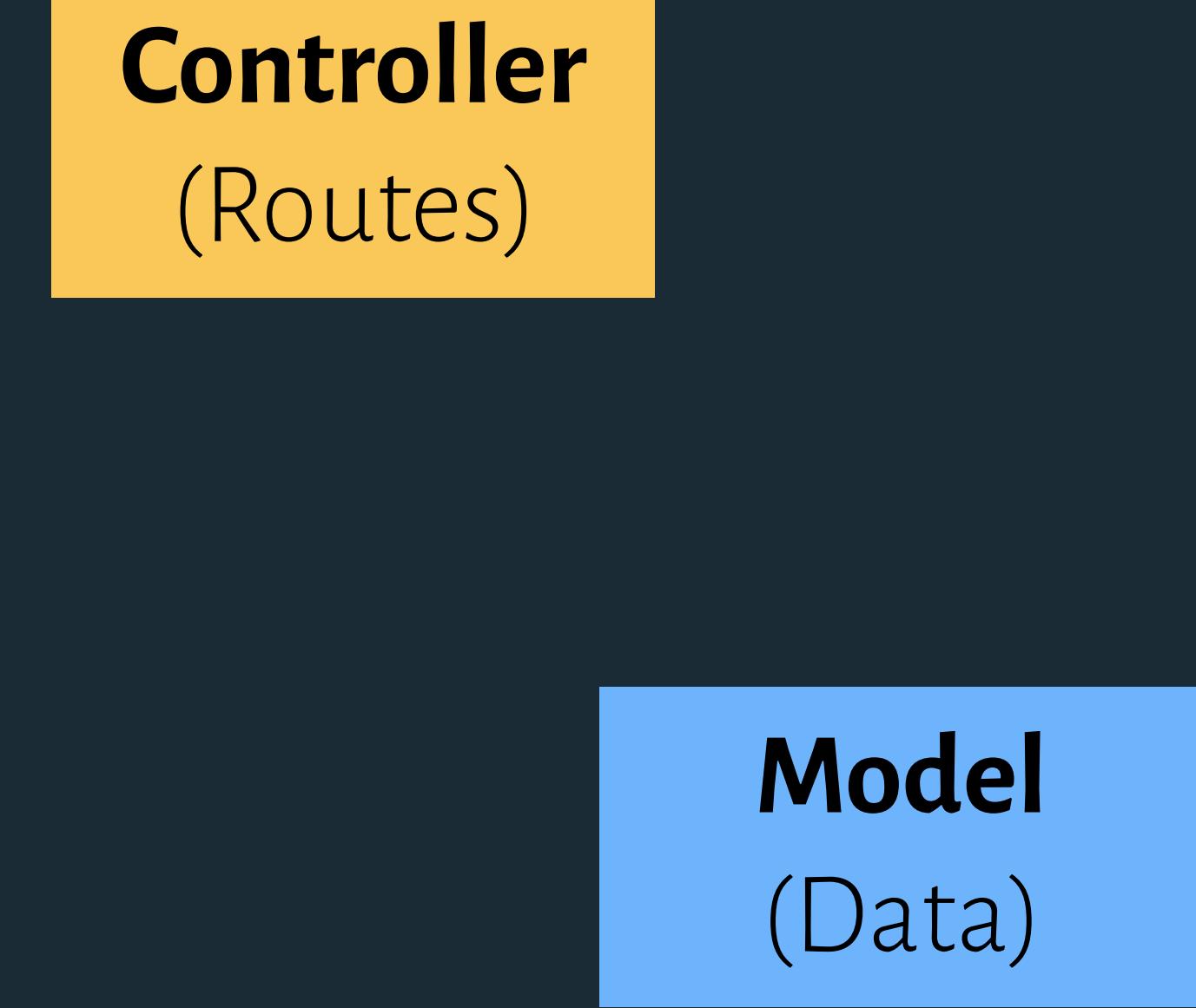
Vertical dashed line separating Client Side from Server Side



Client Side

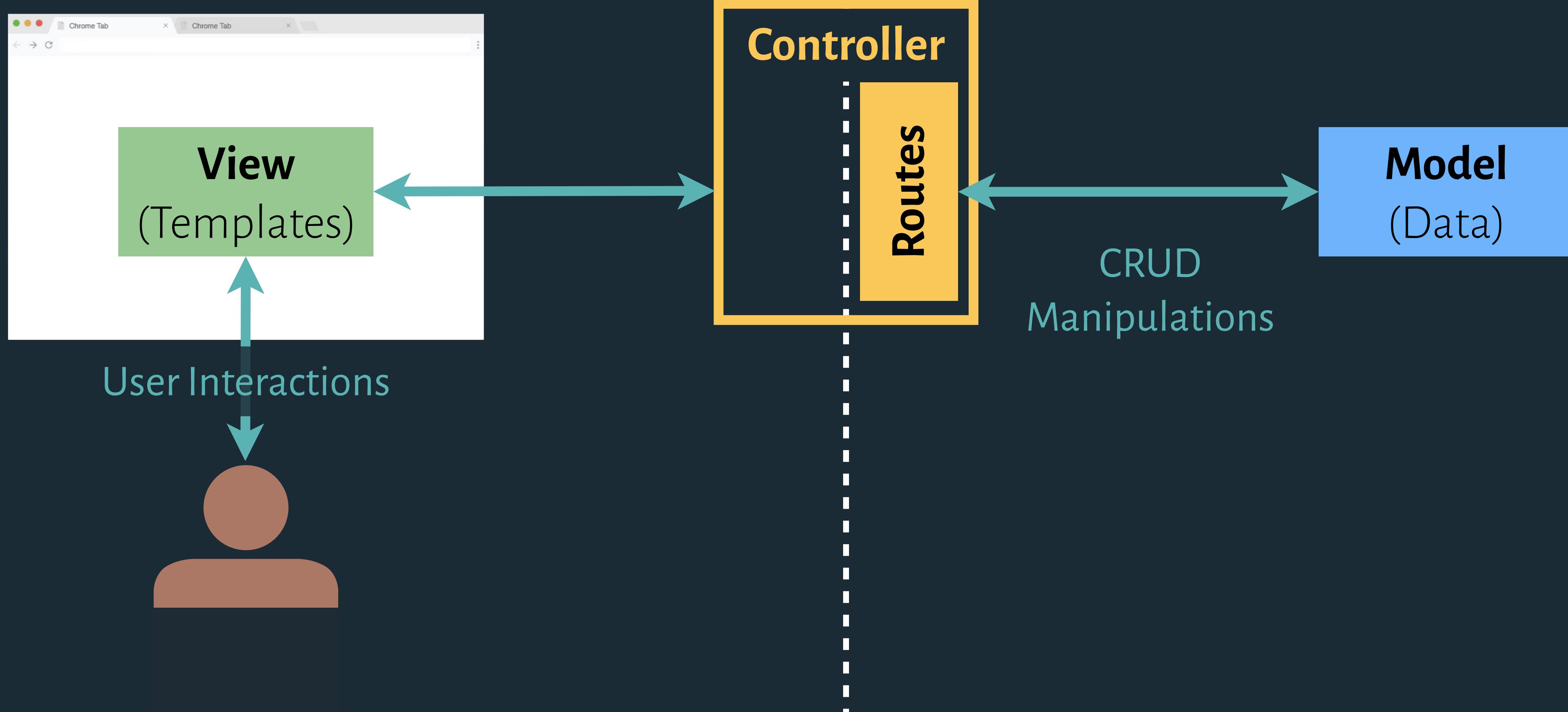


Server Side



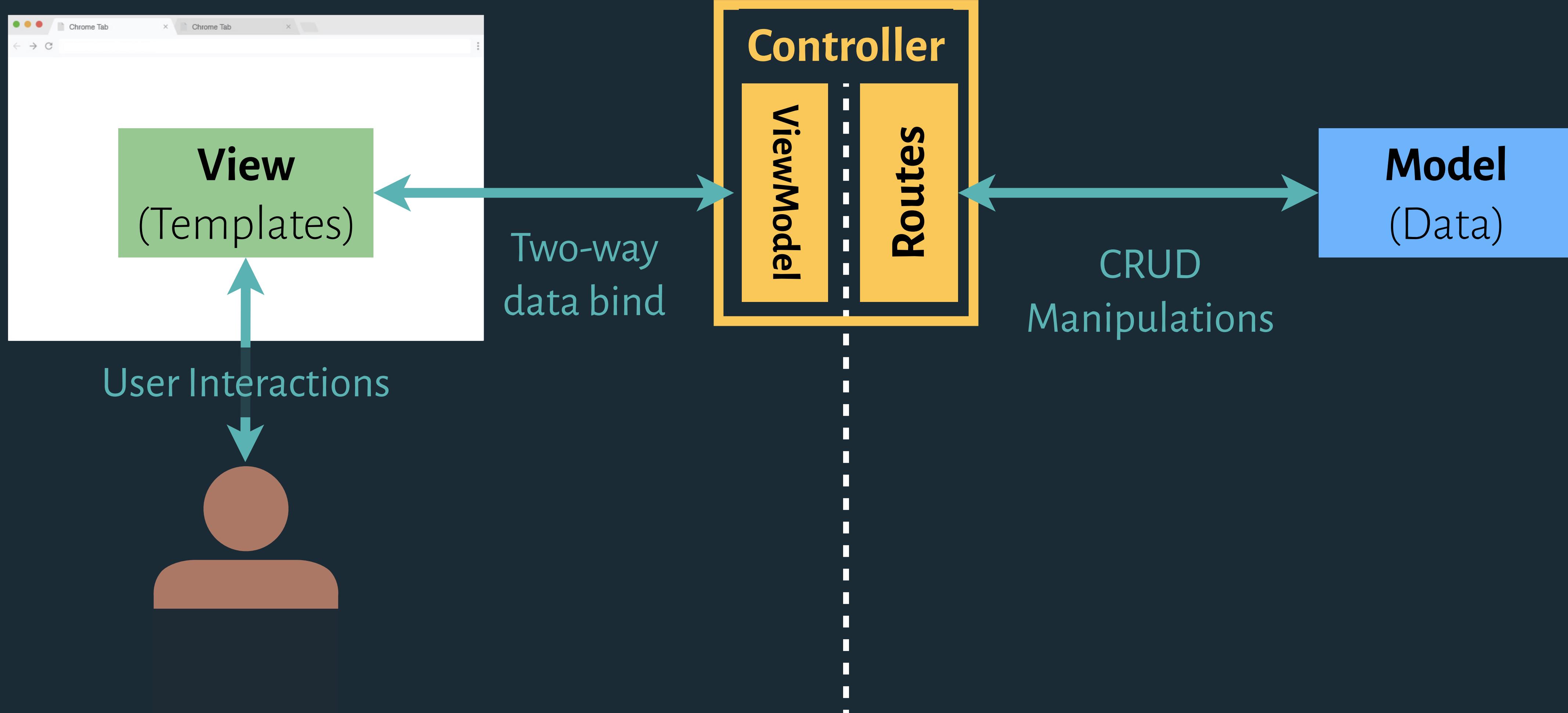
Client Side

Server Side



Client Side

Server Side





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vue.js

- ✓ Small surface area (i.e., fewer new things to learn).
- ✓ Thriving ecosystem + community (i.e., easy to find help).

Note: We are use Vue v2, not v3.

- ✓ Better modularity + separation of concerns via components.

HTML

```
<html>
  <head>
    <link rel="stylesheet"
          href="photos.css">
  </head>

  <body>
    <button>Load More!</button>

    <div id="photos">
    </div>
  </body>
</html>
```

CSS

```
#photos {
  display: flex;
  background: #ccc;
  padding: 5px;
  border: 1px solid #999;
  border-radius: 5px;
}

.photo {
  flex: 1;
  padding: 5px;
  background: white;
}
```

JavaScript

```
const photos =
  document.querySelector('#photos');

document.querySelector('button')
  .addEventListener(function() {
    get('/photos')
      .then(function(data) {
        for (const d of data) {
          const p =
            document.createElement('img');
          photo.src = d.src;
          photos.appendChild(photo);
        }
      })
    });
});
```

Structure + Content

Presentation

Behavior

```
HT  
  
<html>  
  <head>  
    <link rel="s  
          href="ph  
</head>  
  
  <body>  
    <button>Load  
  
    <div id="photo">  
      </div>  
  </body>  
</html>
```

Structure

The New York Times

POLITICS | Back on the Bench, the Supreme Court Faces a Blockbuster Term



By Adam Liptak

Oct. 3, 2021 Updated 12:30 p.m. ET

WASHINGTON — A transformed Supreme Court returns to the bench on Monday to start a momentous term in which it will consider eliminating the constitutional right to abortion, vastly expanding gun rights and further chipping away at the wall separating church and state.

The abortion case, a challenge to a Mississippi law that bars most abortions after 15 weeks, has attracted the most attention. The court, now dominated by six Republican appointees, seems poised to use it to undermine and perhaps overturn [Roe v. Wade](#), the 1973 decision that established a constitutional right to abortion and barred states from banning the procedure before fetal viability.

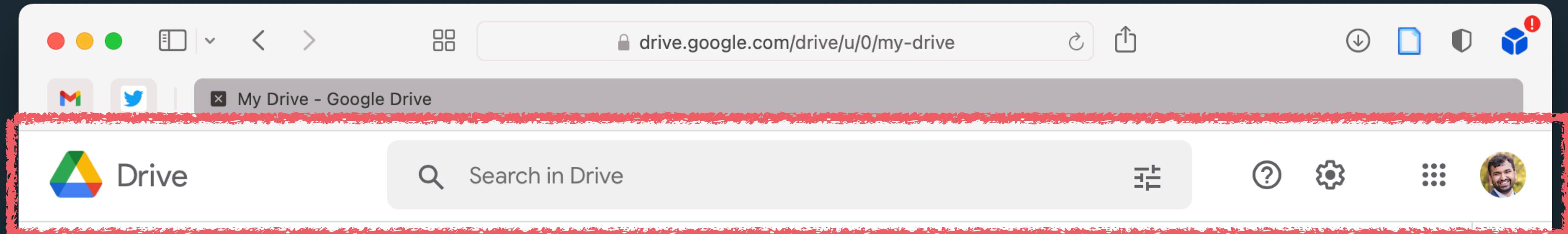
The highly charged docket will test the leadership of Chief Justice John G. Roberts Jr., who lost his position at the court's ideological center with the arrival last fall of Justice Amy Coney Barrett. He is now outflanked by five justices to his right, limiting his ability to guide the court toward the consensus and incrementalism he has

Special offer. Subscribe for \$4.25 \$1 a week.

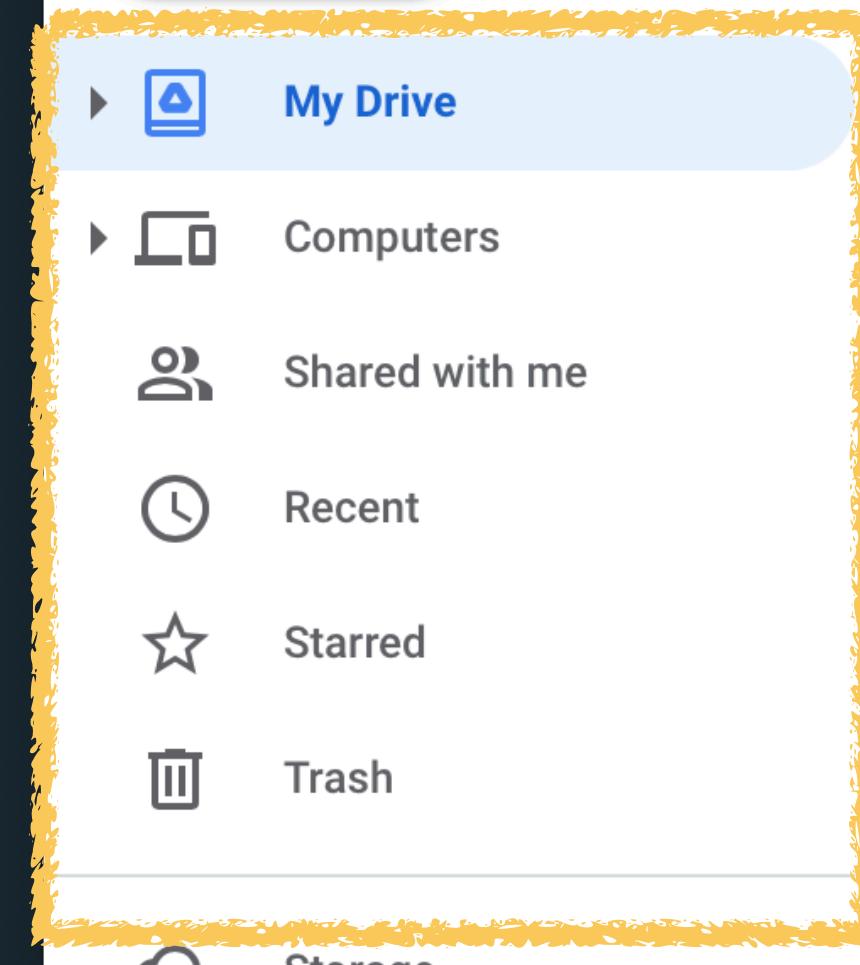
EXPAND ^

```
ript  
  
for ('#photos');  
button')  
tion() {  
} {  
ata) {  
teElement('img');  
src;  
ild(photo);  
or
```

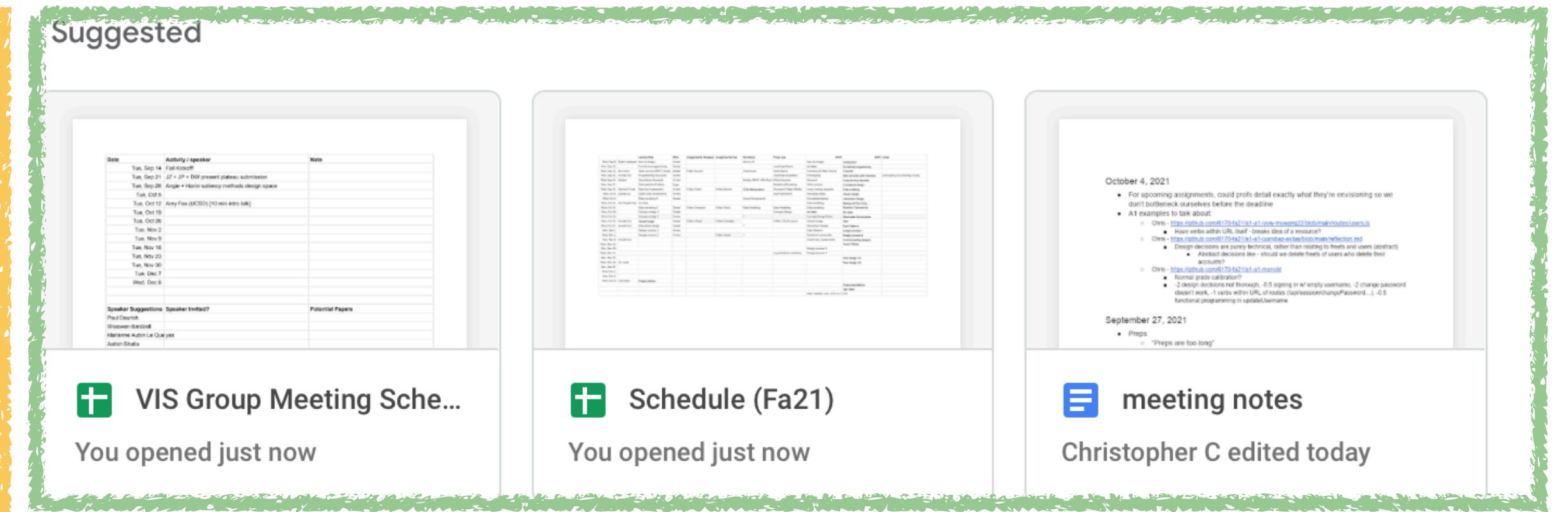
Toolbar



Locations



Suggestions



File Listing

Name	Owner	Last modified
2018 Dagstuhl VIS	Hanspeter Pfister	Nov 14, 2018
2019-07-01_Arvind Satyanarayan	Lourdes M. Aleman	Jul 2, 2019
2020 SSRC COVID rapid response grant		
6170	me	Jan 6, 2020
6894	me	Jan 6, 2020
AwardsReview	Miriah Meyer	Feb 9, 2020
Colah Notebooks	me	Nov 7, 2018