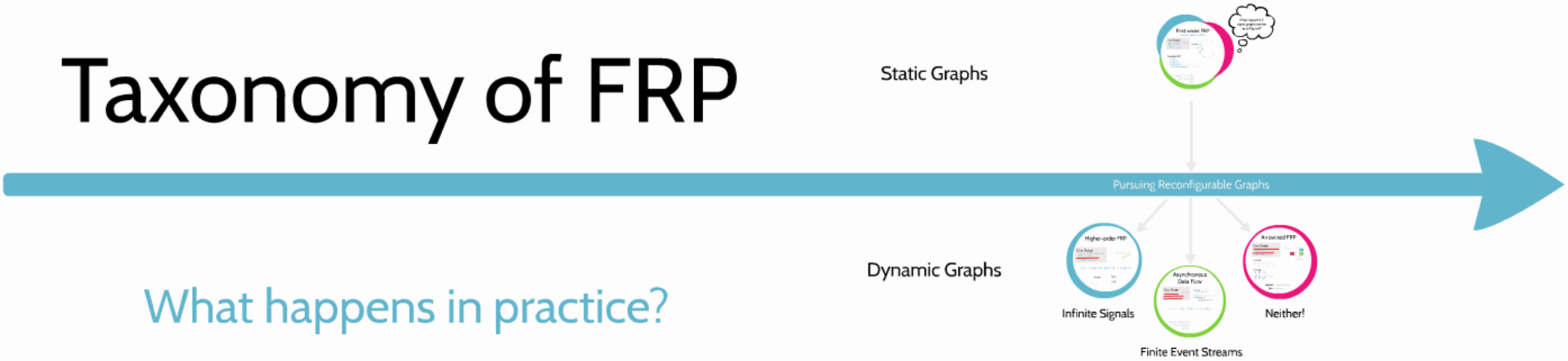
Taxonomy of FRP



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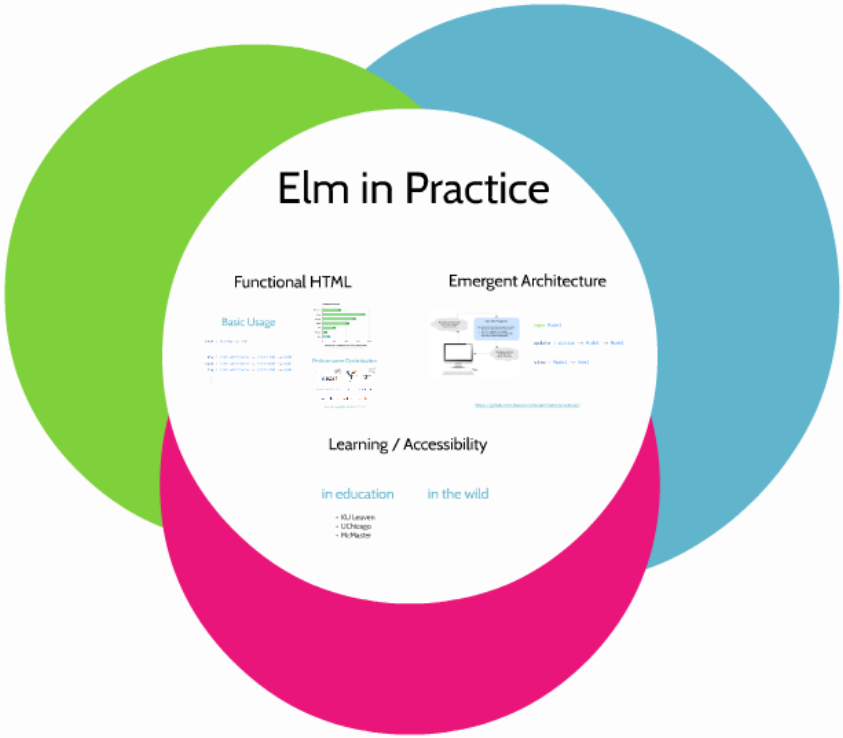

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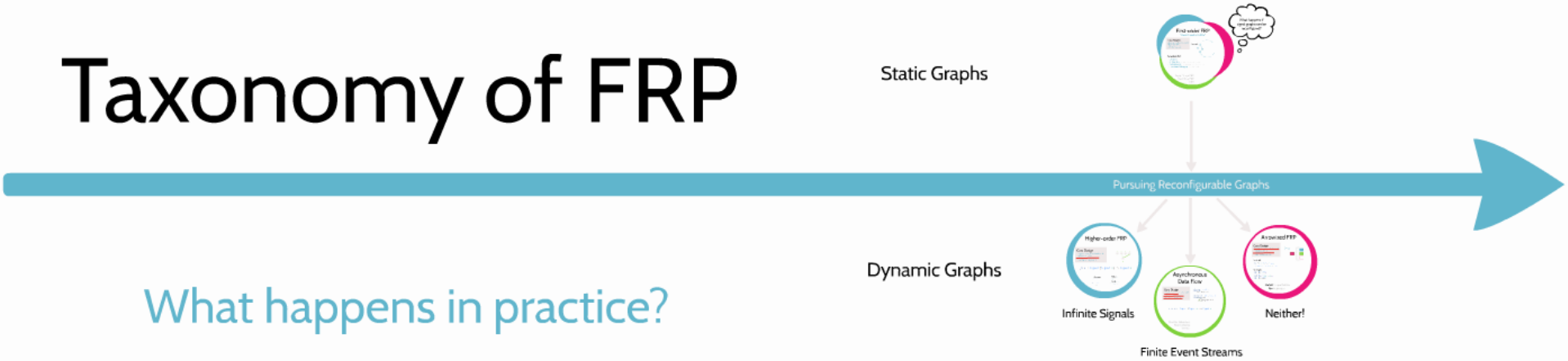

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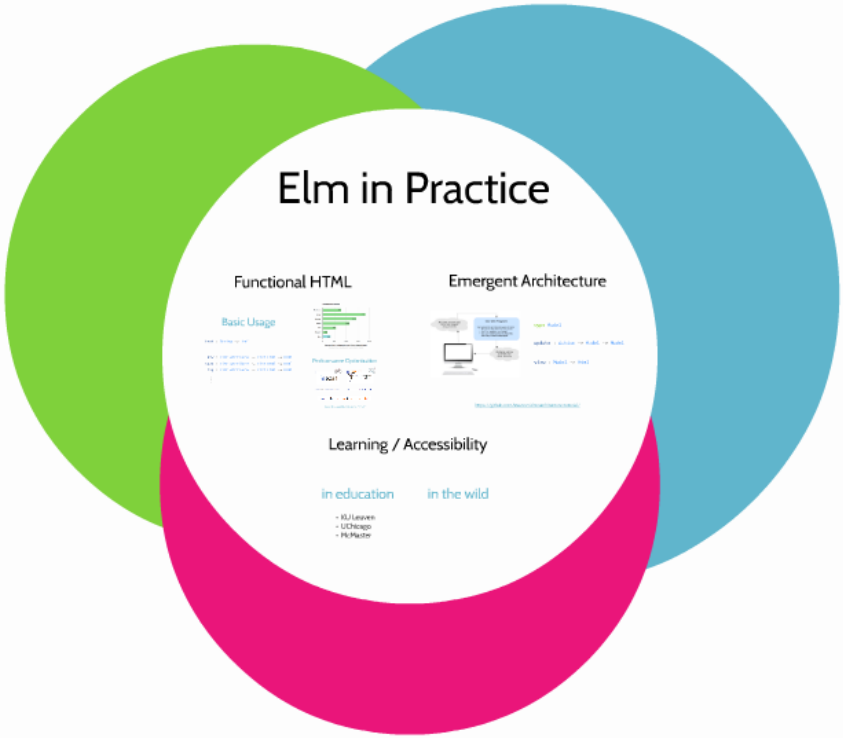

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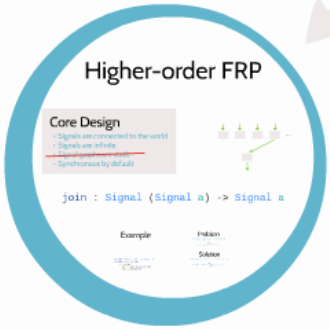
Static Graphs

Pursuing Reconfigurable Graphs

Dynamic Graphs



Infinite Signals

Finite Event Streams

Neither!

First-order FRP

"How it works in Elm"

Core Design

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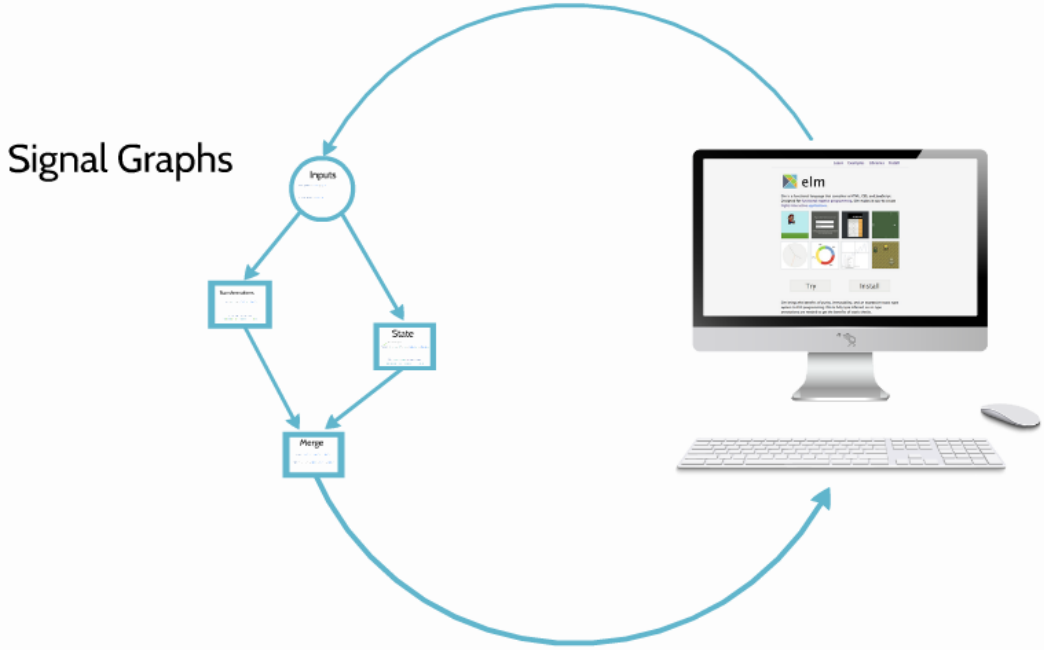

Benefits in Elm

- Efficiency
- Architecture https://github.com/evancz/elm-architecture-tutorial/
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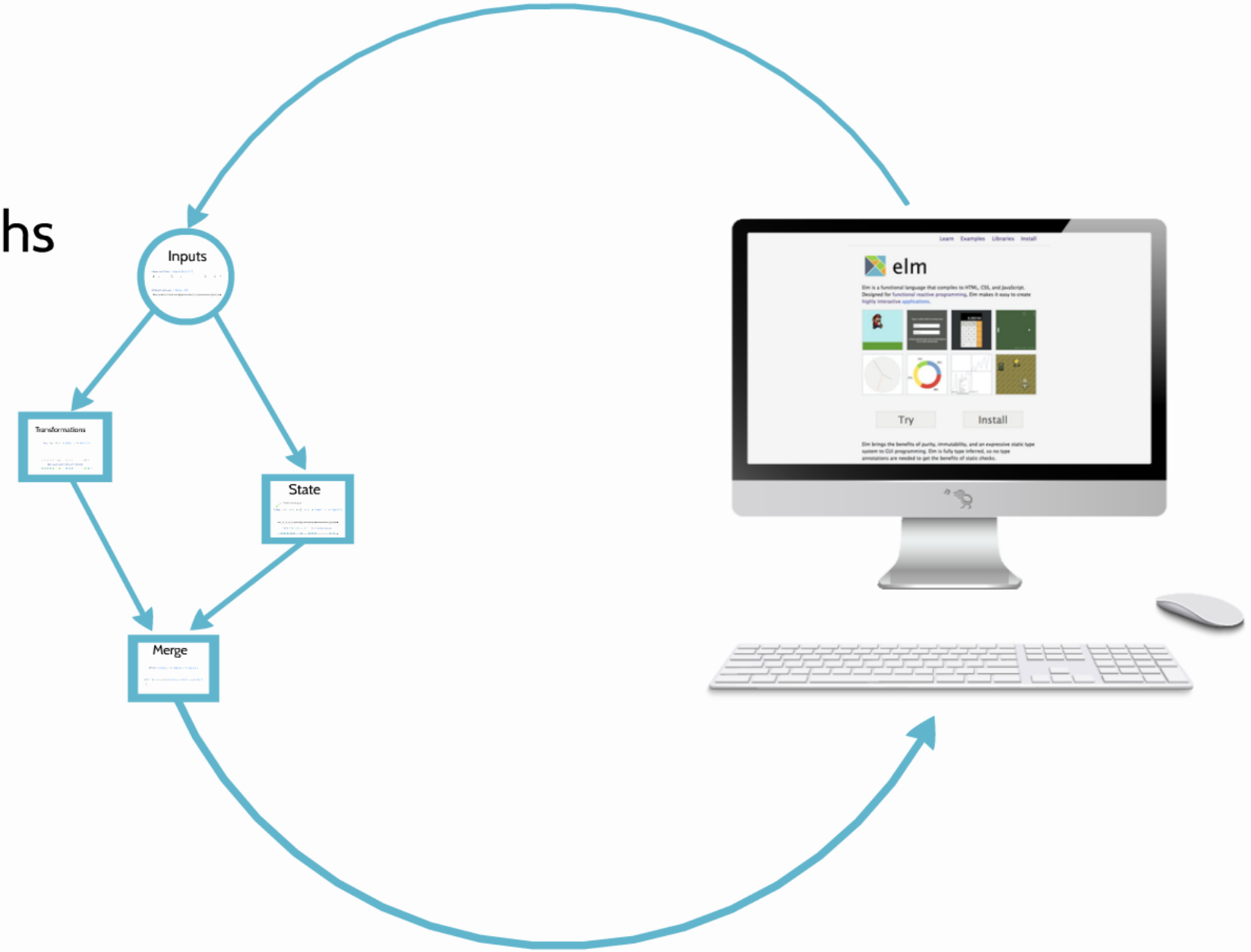

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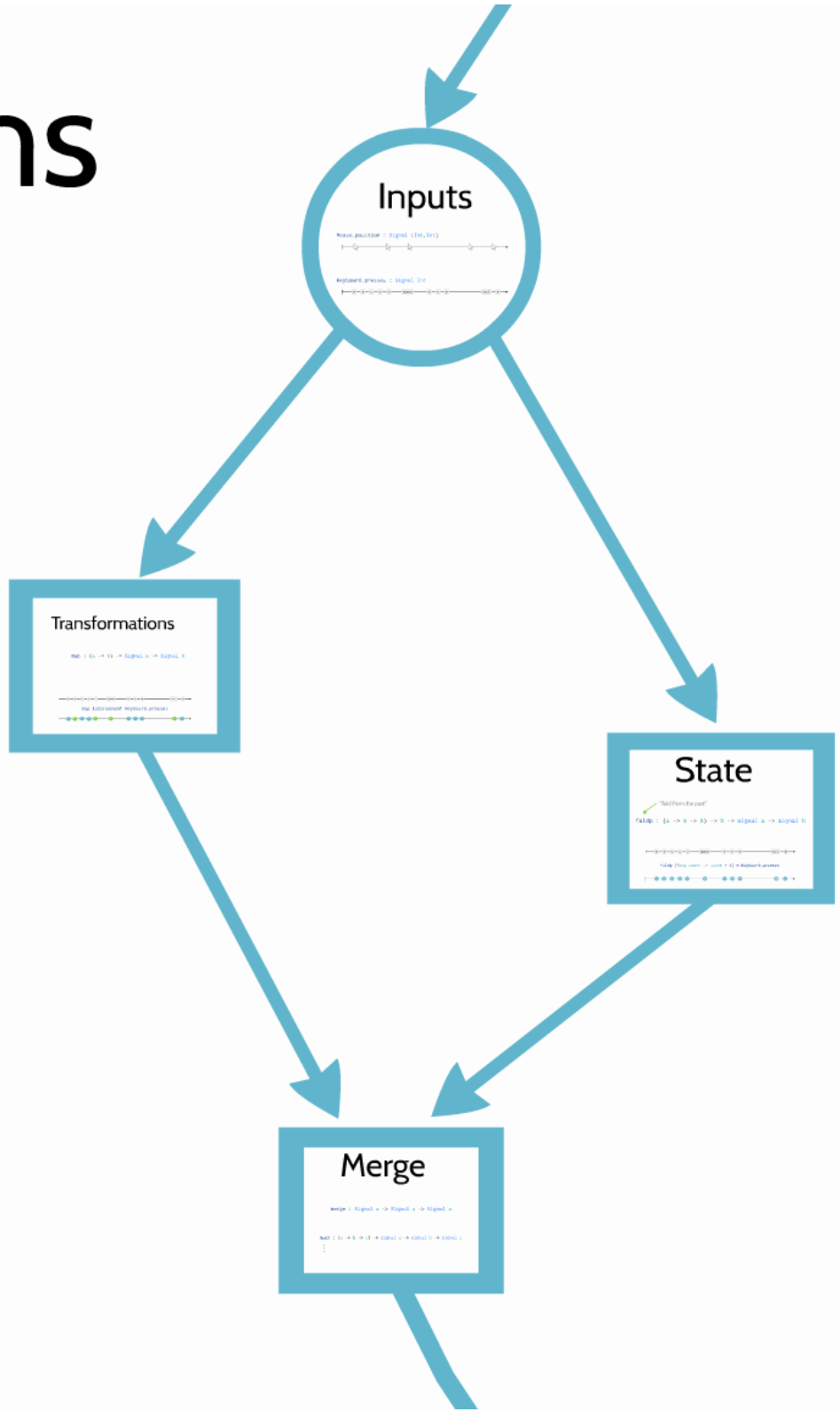
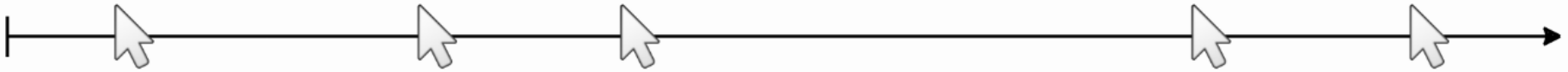
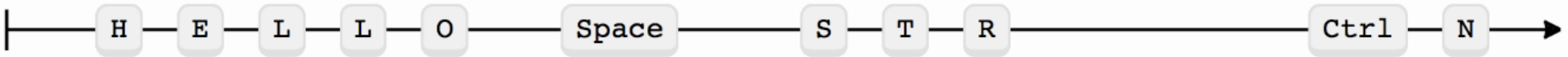


Inputs

```
Mouse.position : Signal (Int,Int)
```

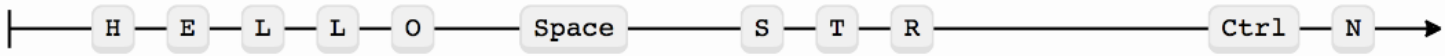


```
Keyboard.presses : Signal Int
```



Transformations

```
map : (a -> b) -> Signal a -> Signal b
```




```
map isConsonant Keyboard.presses
```

State

"fold from the past"

```
foldp : (a -> b -> b) -> b -> Signal a -> Signal b
```


```
foldp (\key count -> count + 1) 0 Keyboard.presses
```

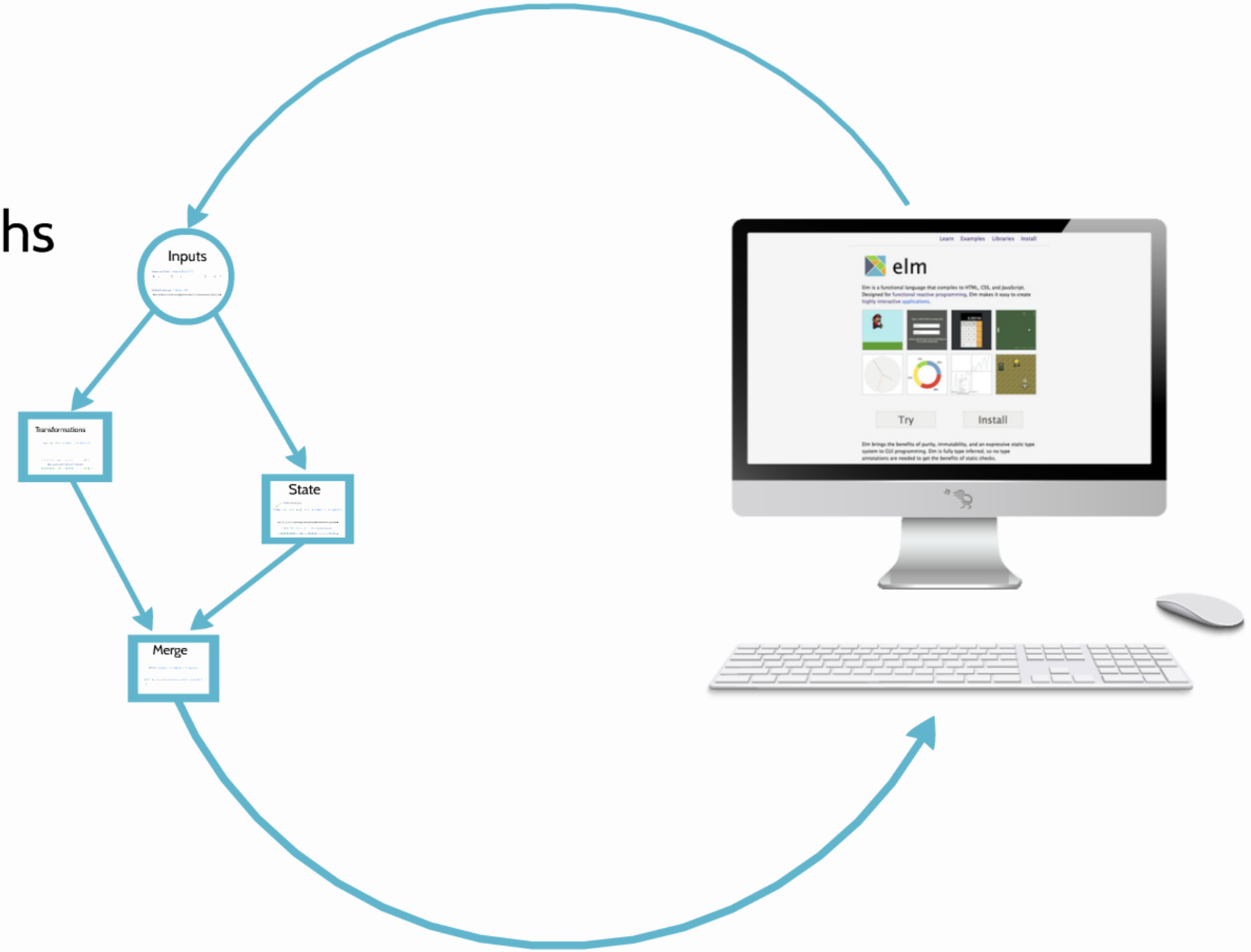
Merge

```
merge : Signal a -> Signal a -> Signal a
```

```
map2 : (a -> b -> c) -> Signal a -> Signal b -> Signal c
```

:
:
:

Signal Graphs



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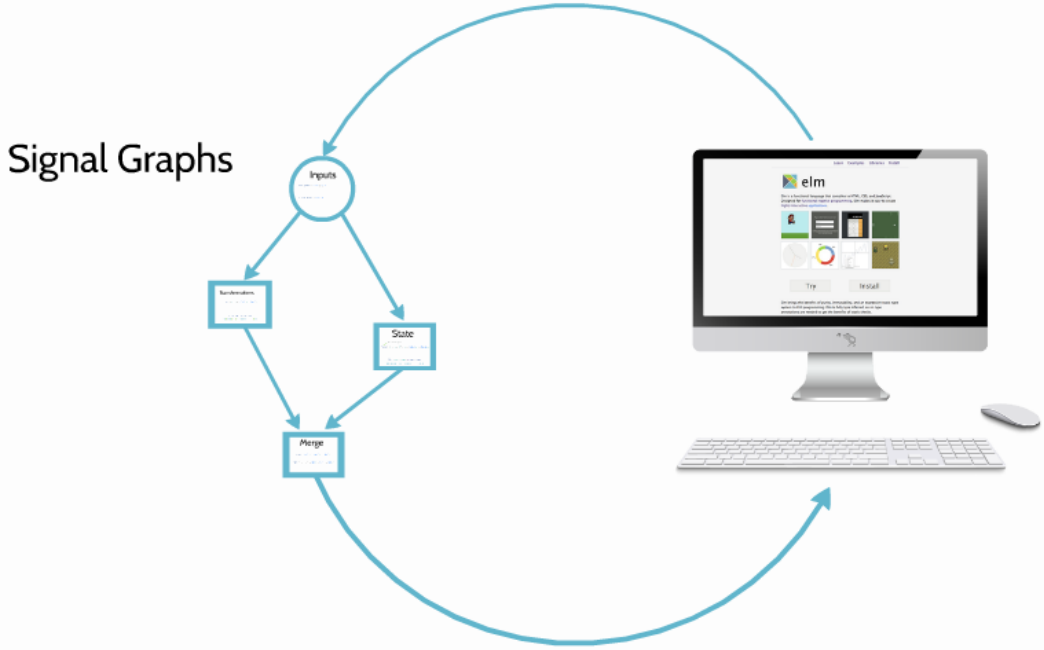

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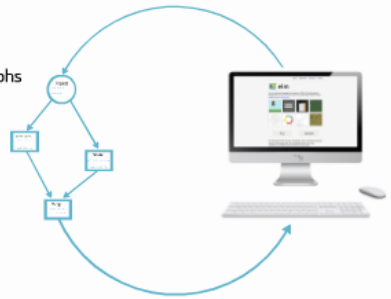

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Event-Driven FRP
Real-Time FRP
Elm

What happens if signal graphs can be reconfigured?

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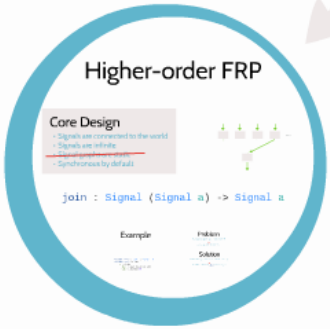
Pursuing Reconfigurable Graphs

Dynamic Graphs



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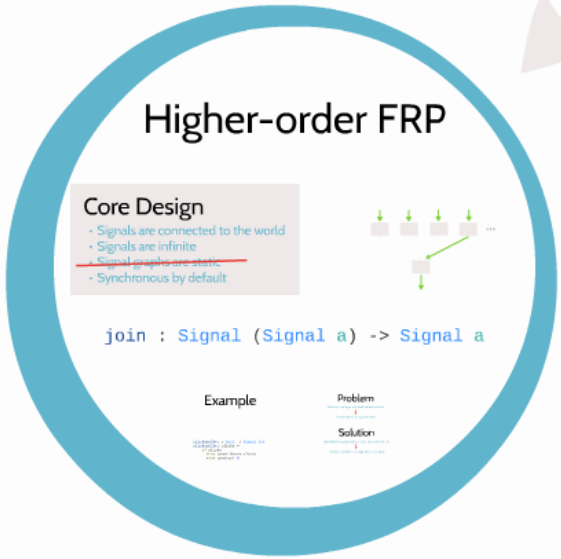

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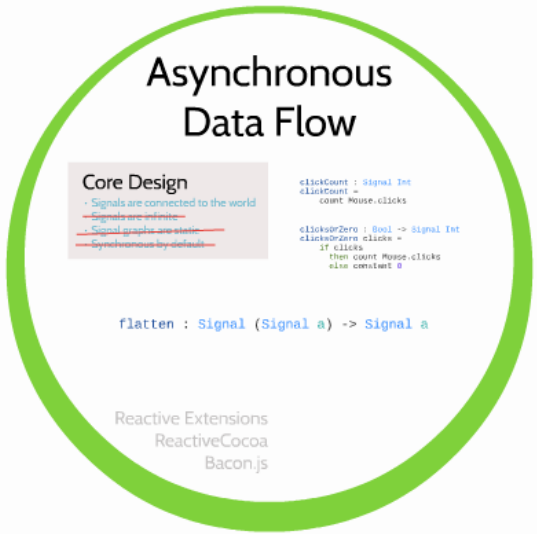

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Higher-order FRP

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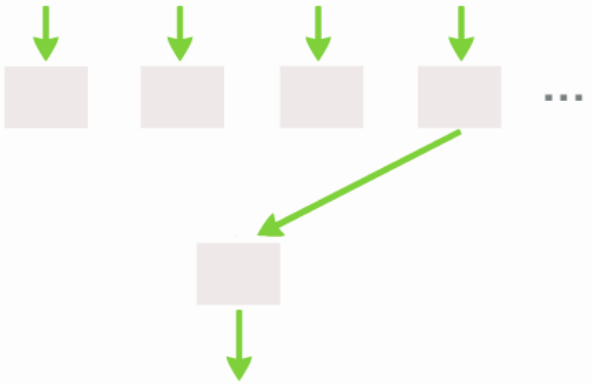

```
join : Signal (Signal a) -> Signal a
```

Example

```
clicksOrZero : Bool -> Signal Int
clicksOrZero clicks =
    if clicks
      then count Mouse.clicks
      else constant 0
```

Problem

Creating a new signal may need infinite look back!

Memory growth is linear with time!

Solution

Only switch to signals that have "safe" amounts of history.

Restrict the definition of `join` with fancier types.

Higher-order FRP

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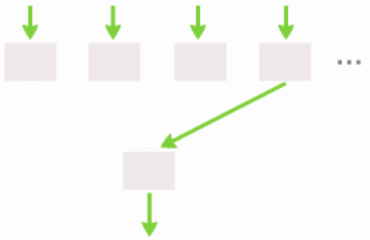

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Asynchronous Data Flow

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```
flatten : Signal (Signal a) -> Signal a
```

Reactive Extensions
ReactiveCocoa
Bacon.js

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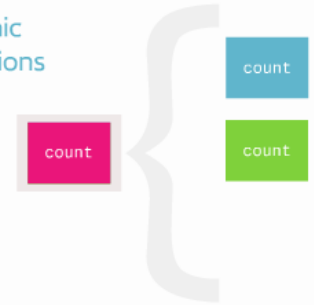

Basic API

```
pure : (a -> b) -> Automaton a b

state : s -> (a -> s -> s) -> Automaton a s

(>>>) : Automaton a b -> Automaton b c -> Automaton a c
```

Examples

```
plus1 : Automaton Int Int
plus1 = pure (\n -> n + 1)

count : Automaton a Int
count = state 0 (\a total -> total + 1)

plus2 : Automaton Int Int
plus2 = plus1 >>> plus1
```

Haskell: Yampa, Netwire

Elm: Automaton

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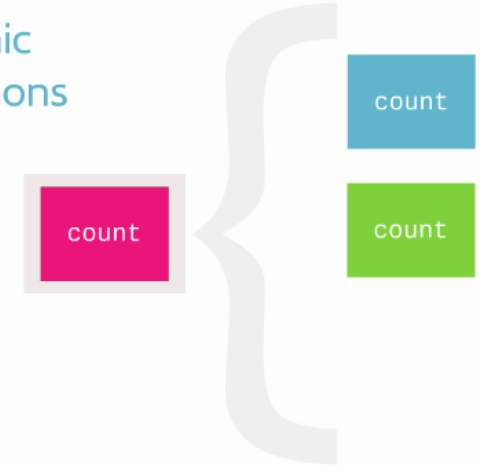

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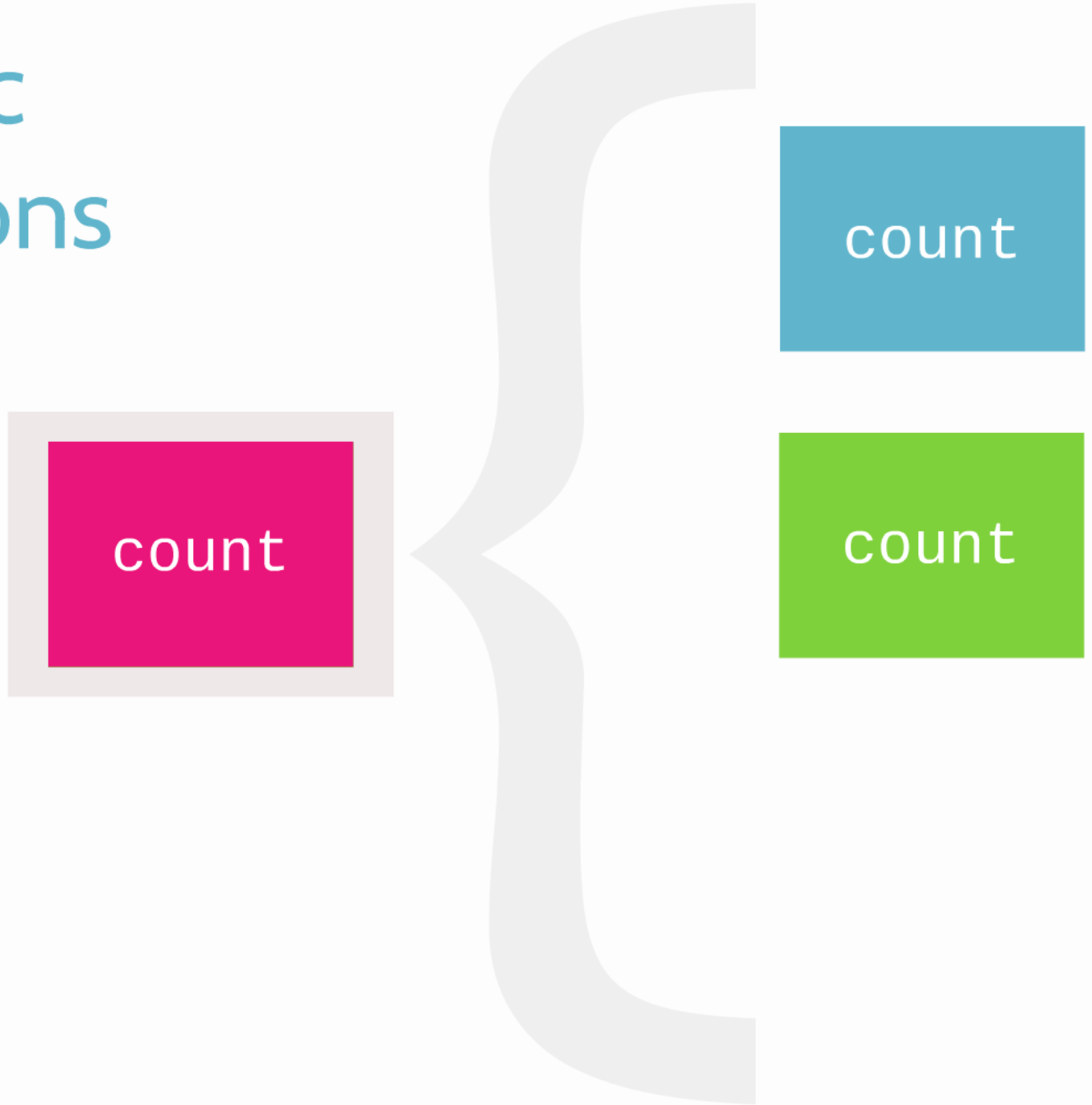

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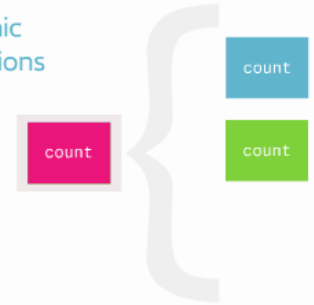

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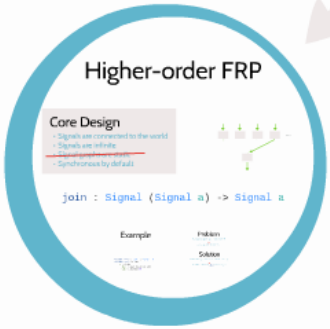

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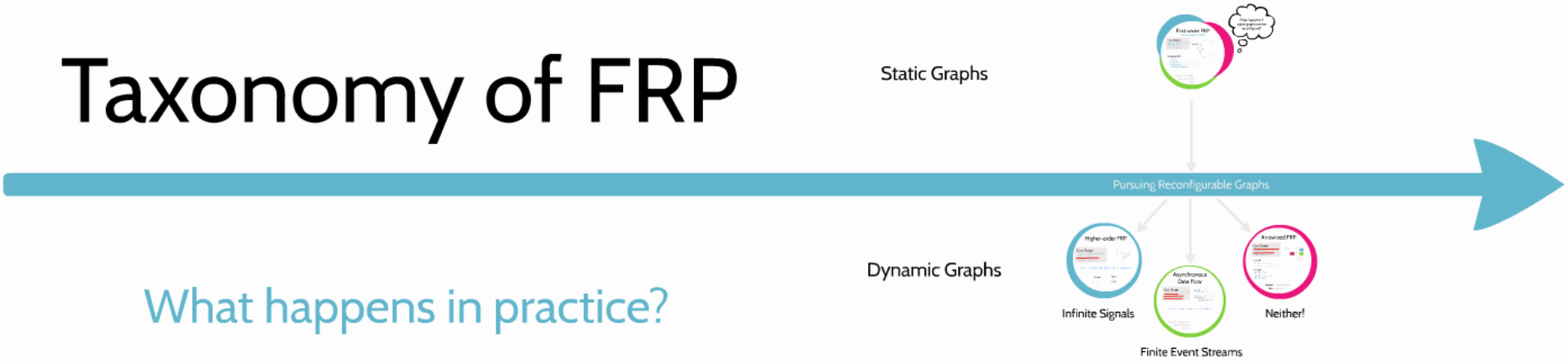

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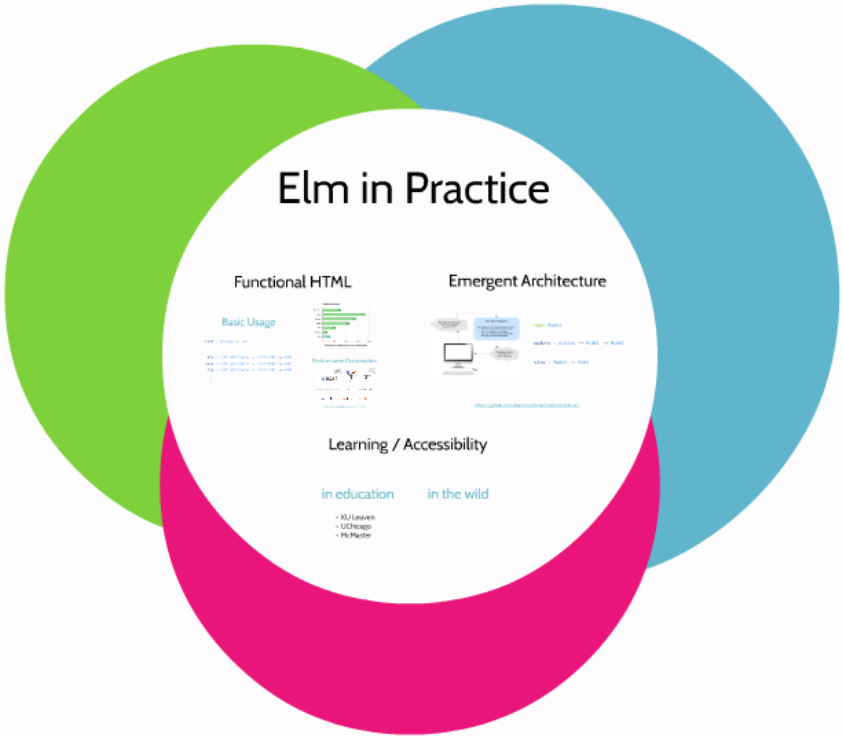

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Elm in Practice

Functional HTML

Basic Usage

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span : List Attribute -> List Html -> Html
img : List Attribute -> List Html -> Html
 :
 :
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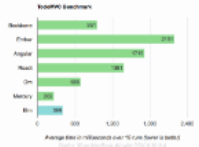
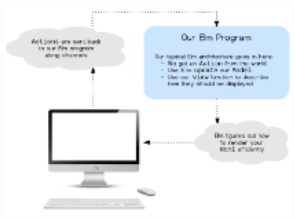


Performance Optimization

```
lazy : (a -> Html) -> a -> Html
```

Emergent Architecture

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type Model

update : Action -> Model -> Model

view : Model -> Html
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https://github.com/evancz/elm-architecture-tutorial/

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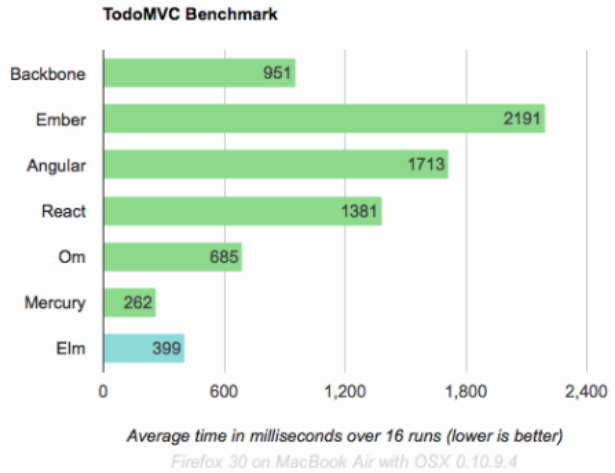

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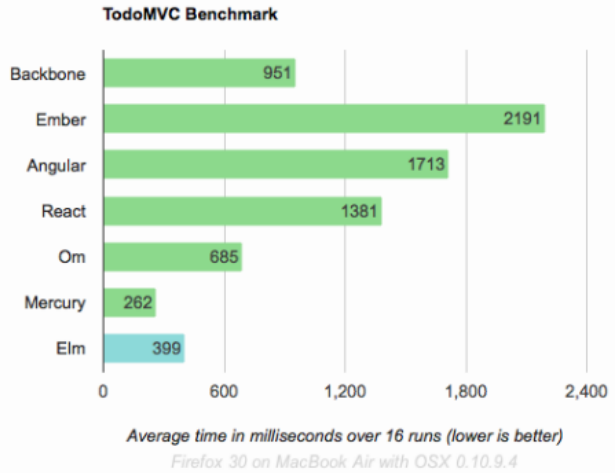

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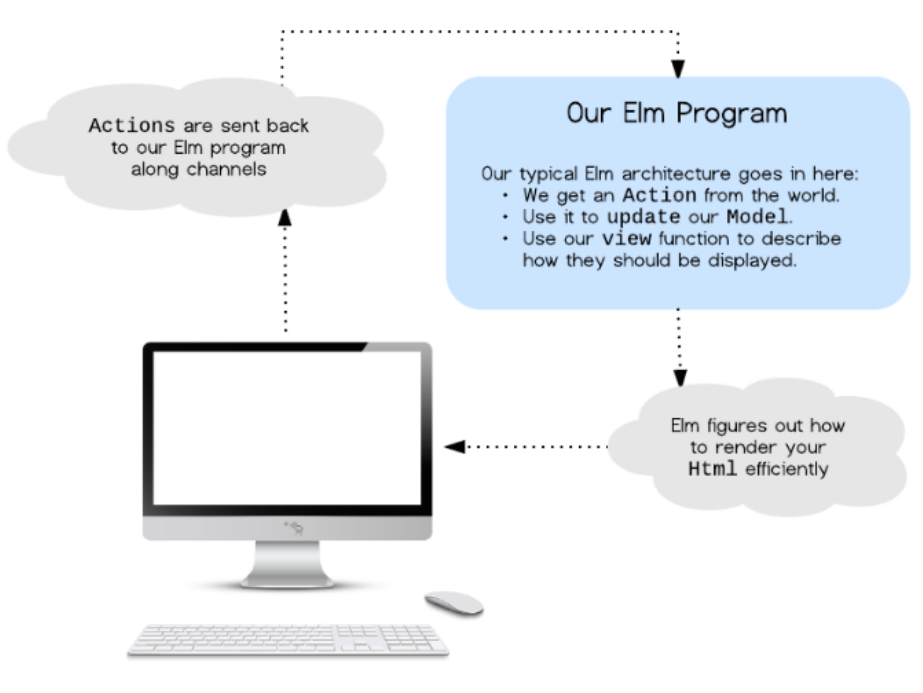


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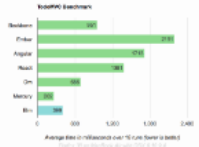

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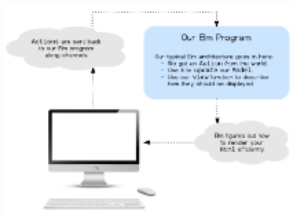


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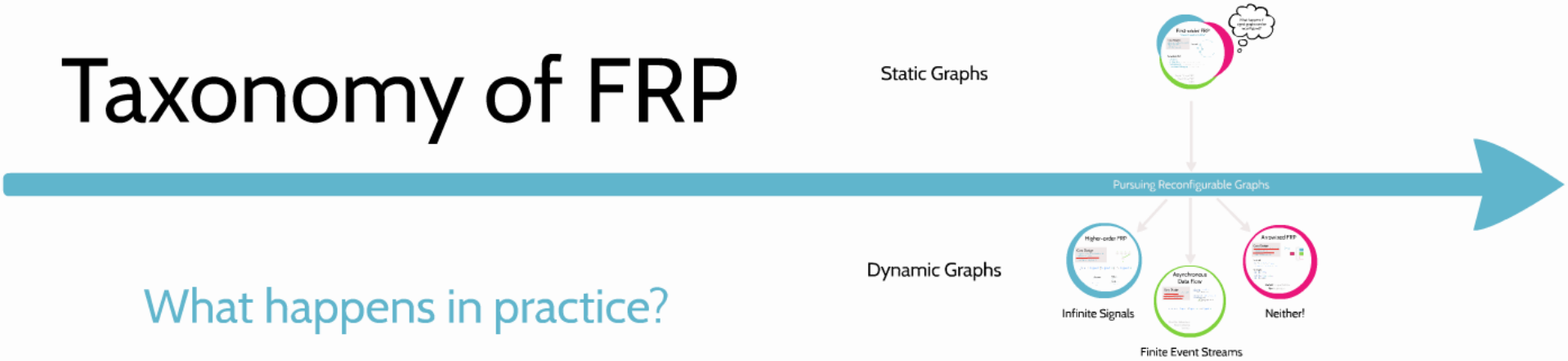
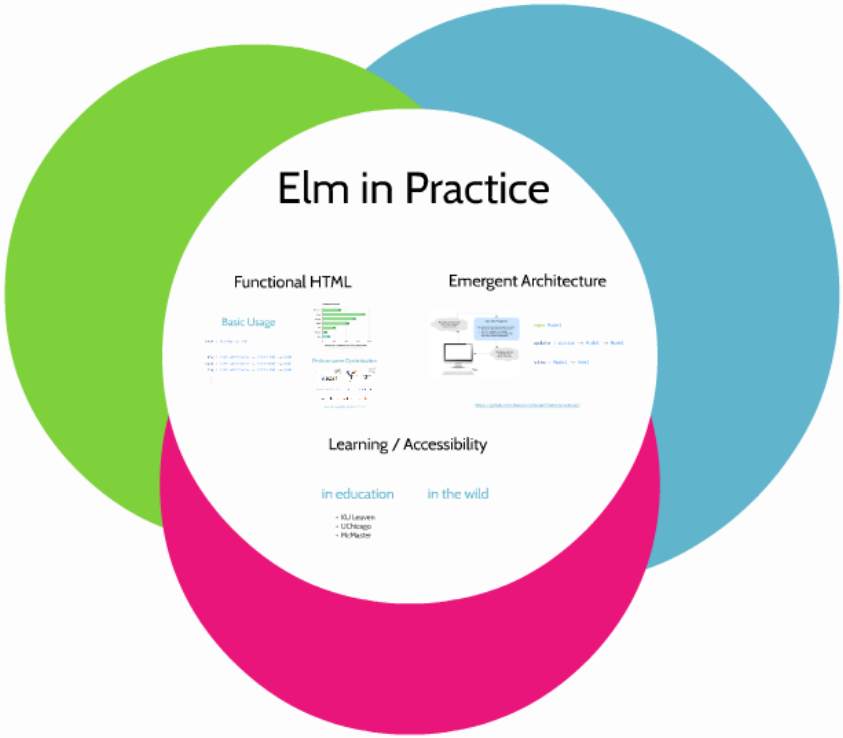
in the wild

Taxonomy of FRP



What happens in practice?



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