Functional Architecture

Brian Lonsdorf
@drboolean

https://bit.ly/2Xq8CU4

Goal?

- Modular
- Extendable
- Performant
- Maintainable
- Readable
- etc

```
    el.innerHTML = id + ': <b>' + ms + 'ms</b><br />' + el.innerHTML;
    el.scrollTop = 0;
}

t = Date.now();

container.innerHTML = '';
        =
this.showTime( container.id + ' clear ', Date.now() - t );
====


for( let i = 0; i < data.length; i++ )
{
    container.appendChild( this.createItem( data[i] ) );
}

window.scrollTo( 0, 0 );

this.showTime( container.id + ' populate', Date.now() - t );

id = item.getAttribute( 'data-id' );
has = _.filter( container.children, e => e.getAttribute( 'data-id' ) === id )
    .length !== 0;

if( !has )
{
    const clone = item.cloneNode( true );

    clone.classList.remove( 'active' );
    clone.getElementsByTagName( 'span' )[0].innerHTML = '';

    container.insertBefore( clone, container.firstChild );
}

item = document.createElement( 'div' );

item.innerHTML = `<span>${ data.id } : ${ data.distance.toFixed( 4 ) }</span>`;
item.classList.add( 'item' );
item.style.width = `${ data.canvas.width }px`;
item.style.height = `${ data.canvas.height }px`;
item.setAttribute( 'data-id', data.id );
item.setAttribute( 'data-original-id', data.originalId );

for( const rect of data.nodes )
{
    const node = document.createElement( 'div' );
    const style = `top:${ rect.y }px; left:${ rect.x }px; width:${
        rect.width
    }px; height:${ rect.height }px`;

    node.innerHTML = rect.id;
    node.setAttribute( 'style', style );

    item.appendChild( node );
}
```

```
    el.innerHTML = id + ': <b>' + ms + 'ms</b><br />' + el.innerHTML;
    el.scrollTop = 0;
}
```

```
t = Date.now();

container.innerHTML = '';

this.showTime( container.id + ' clear ', Date.now() - t );


for( let i = 0; i < data.length; i++ )
{
    container.appendChild( this.createItem( data[i] ) );
}

window.scrollTo( 0, 0 );

this.showTime( container.id + ' populate', Date.now() - t );
```

```
id = item.getAttribute( 'data-id' );
has = _.filter( container.children, e => e.getAttribute( 'data-id' ) === id )
    .length !== 0;

if( !has )
{
    const clone = item.cloneNode( true );

    clone.classList.remove( 'active' );
    clone.getElementsByTagName( 'span' )[0].innerHTML = '';

    container.insertBefore( clone, container.firstChild );
}

item = document.createElement( 'div' );
```

```
item.innerHTML = `<span>${ data.id } : ${ data.distance.toFixed( 4 ) }</span>`;
item.classList.add( 'item' );
item.style.width = `${ data.canvas.width }px`;
item.style.height = `${ data.canvas.height }px`;
item.setAttribute( 'data-id', data.id );
item.setAttribute( 'data-original-id', data.originalId );

for( const rect of data.nodes )
{
    const node = document.createElement( 'div' );
    const style = `top:${ rect.y }px; left:${ rect.x }px; width:${
        rect.width
    }px; height:${ rect.height }px`;

    node.innerHTML = rect.id;
    node.setAttribute( 'style', style );

    item.appendChild( node );
}
```

```
    el.innerHTML = id + ': <b>' + ms + 'ms</b><br />' + el.innerHTML;
    el.scrollTop = 0;
}
```

```
t = Date.now();

container.innerHTML = '';

this.showTime( container.id + ' clear ', Date.now() - t );


for( let i = 0; i < data.length; i++ )
{
    container.appendChild( this.createItem( data[i] ) );
}

window.scrollTo( 0, 0 );

this.showTime( container.id + ' populate', Date.now() - t );
```

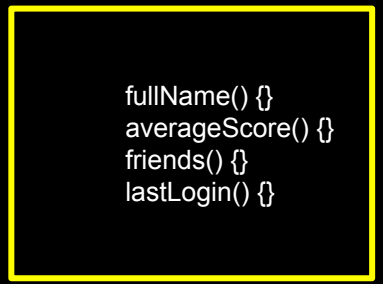
populateContainer

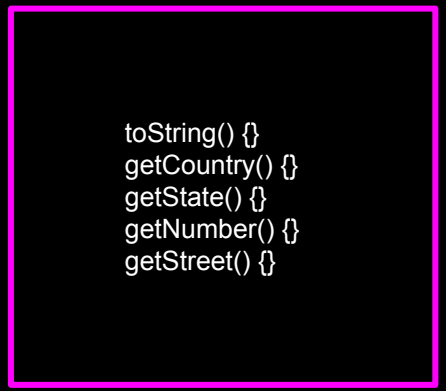
```
id = item.getAttribute( 'data-id' );
has = _.filter( container.children, e => e.getAttribute( 'data-id' ) === id )
    .length !== 0;

if( !has )
{
    const clone = item.cloneNode( true );

    clone.classList.remove( 'active' );
    clone.getElementsByTagName( 'span' )[0].innerHTML = '';

    container.insertBefore( clone, container.firstChild );
}

item = document.createElement( 'div' );
```

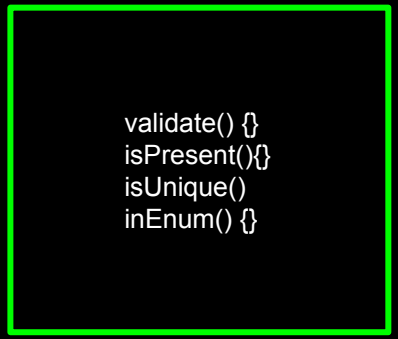
makeItemActive

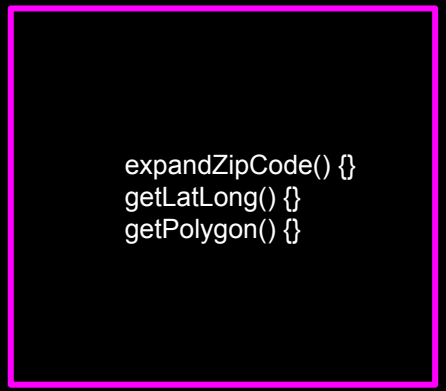
```
item.innerHTML = `<span>${ data.id } : ${ data.distance.toFixed( 4 ) }</span>`;
item.classList.add( 'item' );
item.style.width = `${ data.canvas.width }px`;
item.style.height = `${ data.canvas.height }px`;
item.setAttribute( 'data-id', data.id );
item.setAttribute( 'data-original-id', data.originalId );

for( const rect of data.nodes )
{
    const node = document.createElement( 'div' );
    const style = `top:${ rect.y }px; left:${ rect.x }px; width:${
        rect.width
    }px; height:${ rect.height }px`;

    node.innerHTML = rect.id;
    node.setAttribute( 'style', style );

    item.appendChild( node );
}
```

renderPattern

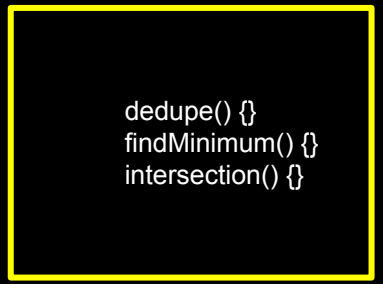

fullName() {}
averageScore() {}
friends() {}
lastLogin() {}

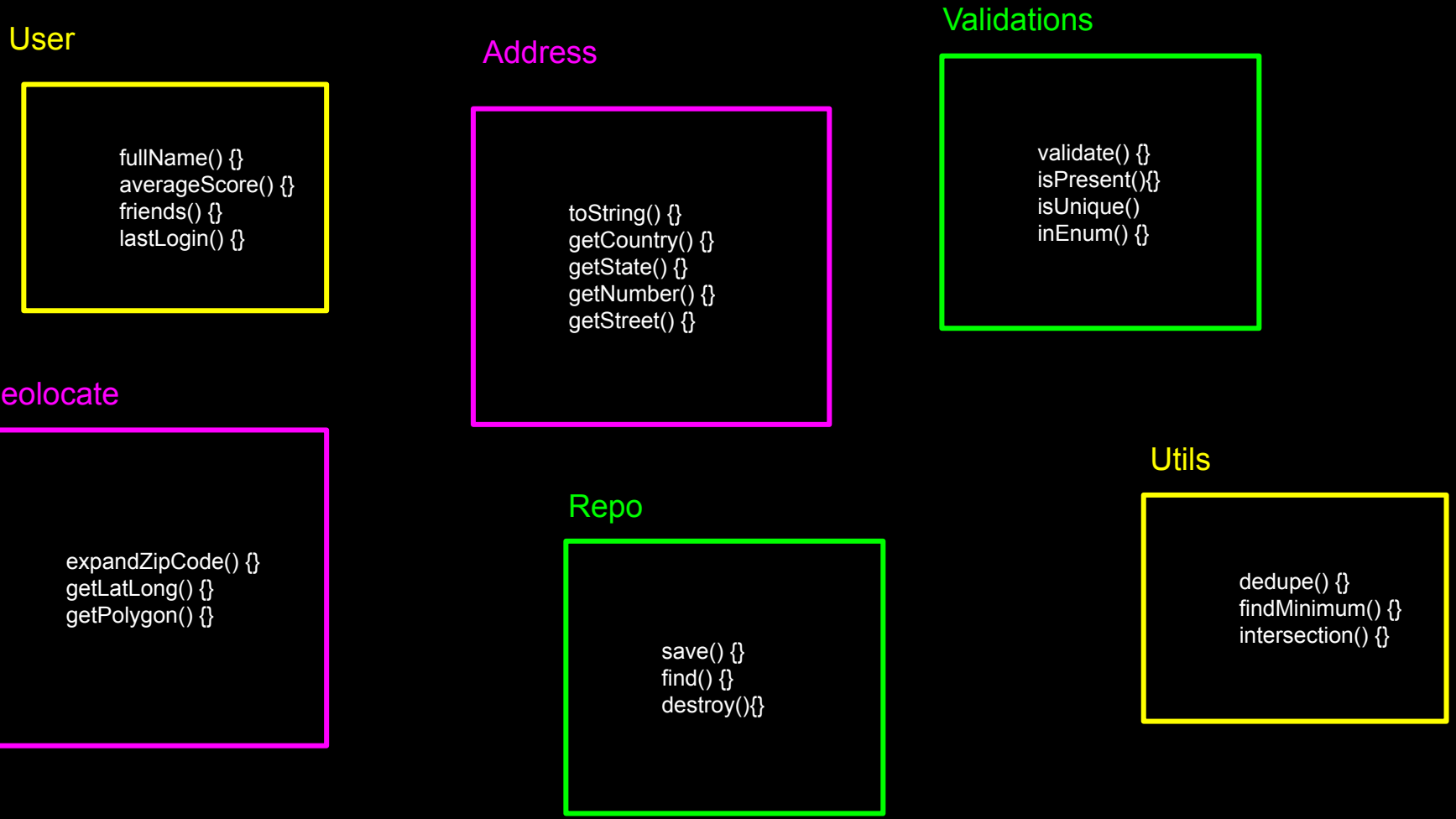

toString() {}
getCountry() {}
getState() {}
getNumber() {}
getStreet() {}


validate() {}
isPresent(){}
isUnique()
inEnum() {}


expandZipCode() {}
getLatLong() {}
getPolygon() {}


save() {}
find() {}
destroy(){}


dedupe() {}
findMinimum() {}
intersection() {}


User
fullName() {}
averageScore() {}
friends() {}
lastLogin() {}
Address
toString() {}
getCountry() {}
getState() {}
getNumber() {}
getStreet() {}
Validations
validate() {}
isPresent(){}
isUnique()
inEnum() {}
Geolocate
expandZipCode() {}
getLatLong() {}
getPolygon() {}
Repo
save() {}
find() {}
destroy(){}
Utils
dedupe() {}
findMinimum() {}
intersection() {}

```
{street, number, state, county, country, zipcode }
```

```
{firstName, lastName, email, username, address, score, friends }
```

```
{ backgroundColor, amountPerPage, expanded, resolution }
```

```
{street, number, state, county, country, zipcode }
```

Address

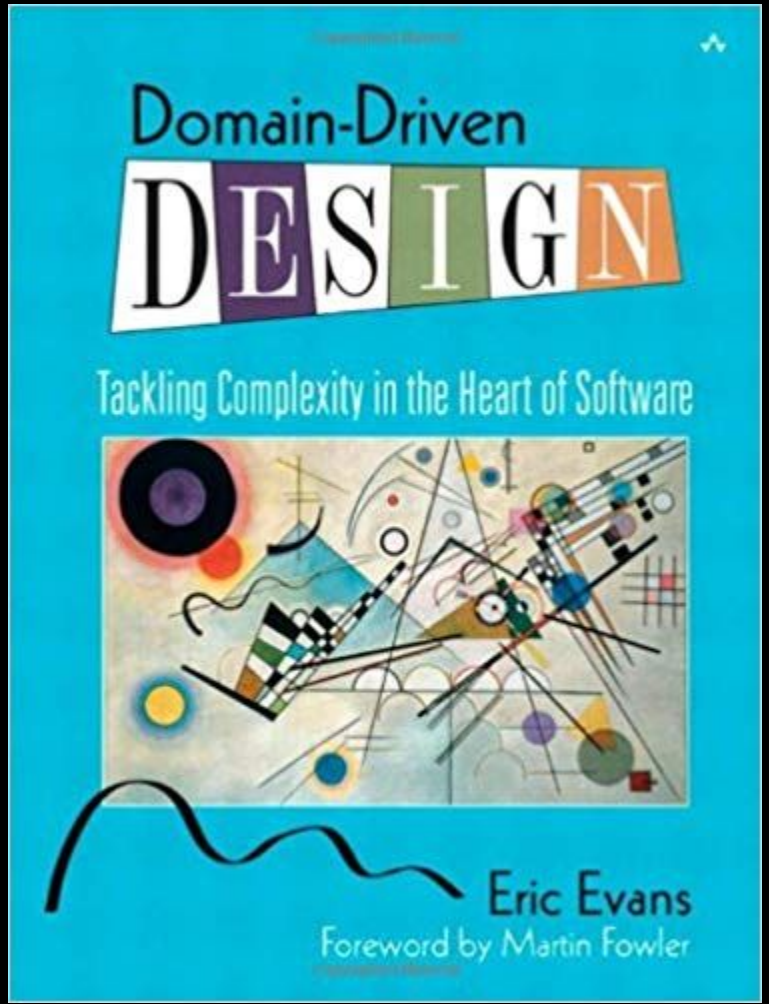
```
{firstName, lastName, email, username, address, score, friends }
```

User

```
{ backgroundColor, amountPerPage, expanded, resolution }
```

Preferences

file
modified
line
number
content
repo
files
github
violations
@payload
filename
name
head
data
request
config
id
initialize
token
payload
patch
position
validates
message
full
contents
team
lines
pull
api
sha
true
nil
additions
memberships
many
include
belongs
presence
@github
@config
commit
changed
generate
admin
comment
Struct.new
ActiveRecord::Base
LINE
active
@modified
violation.line
line.line
map
violations.select
action
violation
ModifiedFile.new
file.modified
GithubApi.new
configuration
username
investigate
custom
parsed
uuid
removed
attributes
create
guide
teams
style
relevant
else
parse
repository
opened
synchronize
@payload.action
INFORMATION
@pull
@custom
CONFIG
RULES
RANGE
IGNORED
ActiveModel::ForbiddenAttributesProtection
self
body
lines.detect
file.filename
remember
REMOVED
MODIFIED


Domain-Driven
DESIGN
Tackling Complexity in the Heart of Software
Eric Evans
Foreword by Martin Fowler

Metaphors?

```
save(name, callback) {
  const todo = this.createTodo(name)
  if(name.trim()) {
    if(find(this.todos, t => t.name == todo.name)) {
      return callback("duplicate todo")
    } else {
      this.todos.unshift(todo)
      this.setTodos(callback)
    }
  } else {
    return callback("name can't be empty")
  }
}

toggle(todo, callback) {
  todo.toggleComplete()
  this.setTodos(callback)
}
```

- Know about context and domain
- Mixed metaphors: Processor, Converter, etc
- Evolves/Blurs over time
- Hodge-podge of functionality in each object

Procedures

```
save(name, callback) {
  const todo = this.createTodo(nane)
  if(name.trim()) {
    if(find(this.todos, t => t.name == todo.name)) {
      return callback("duplicate todo")
    } else {
      this.todos.unshift(todo)
      this.setTodos(callback)
    }
  } else {
    return callback("name can't be empty")
  }
}

toggle(todo, callback) {
  todo.toggleComplete()
  this.setTodos(callback)
}
```

```
save(name, callback) {
  const todo = this.createTodo(name)
  if(name.trim()) {
    if(find(this.todos, t => t.name == todo.name)) {
      return callback("duplicate todo")
    } else {
      this.todos.unshift(todo)
      this.setTodos(callback)
    }
  } else {
    return callback("name can't be empty")
  }
}

toggle(todo, callback) {
  todo.toggleComplete()
  this.setTodos(callback)
}
```

```
save(name, callback) {
  const todo = this.createTodo(nane)
  if(name.trim()) {
    if(find(this.todos, t => t.name == todo.name)) {
      return callback("duplicate todo")
    } else {
      this.todos.unshift(todo)
      this.setTodos(callback)
    }
  } else {
    return callback("name can't be empty")
  }
}

toggle(todo, callback) {
  todo.toggleComplete()
  this.setTodos(callback)
}
```

Procedures

```
save(name, callback) {
  const todo = this.createTodo(nane)
  if(name.trim()) {
    if(find(this.todos, t => t.nane == todo.name)) {
      return callback("duplicate todo")
    } else {
      this.todos.unshift(todo)
      this.setTodos(callback)
    }
  } else {
    return callback("name can't be empty")
  }
}

toggle(todo, callback) {
  todo.toggleComplete()
  this.setTodos(callback)
}
```

```
save(name, callback) {
  const todo = this.createTodo(name)
  if(name.trim()) {
    if(find(this.todos, t => t.name == todo.name)) {
      return callback("duplicate todo")
    } else {
      this.todos.unshift(todo)
      this.setTodos(callback)
    }
  } else {
    return callback("name can't be empty")
  }
}

toggle(todo, callback) {
  todo.toggleComplete()
  this.setTodos(callback)
}
```

```
save(name, callback) {
  const todo = this.createTodo(nane)
  if(name.trim()) {
    if(find(this.todos, t => t.nane == todo.name)) {
      return callback("duplicate todo")
    } else {
      this.todos.unshift(todo)
      this.setTodos(callback)
    }
  } else {
    return callback("name can't be empty")
  }
}

toggle(todo, callback) {
  todo.toggleComplete()
  this.setTodos(callback)
}
```

- Can i run this twice in a row?
- Which order do I need to run these in?
- Is it changing other parts of the program?
- How does it interact with others?

```
// associative
add(add(x, y), z) == add(x, add(y, z))

// commutative
add(x, y) == add(y, x)

// identity
add(x, 0) == x

// distributive
add(multiply(x, y), multiply(x, z)) == multiply(x, add(y,z))
```

Functions with defined contracts

```
class User {
  constructor(firstName, lastName) {
    this.firstName = firstName
    this.lastName = lastName
  }

  fullName() {
    return this.firstName + ' ' + this.lastName
  }
}


const user = new User('Bobby', 'Fischer')
user.fullName()
// Bobby Fischer
```

```
const user = {firstName: 'Bobby', lastName: 'Fischer'}
const fullName = (firstName, lastName) => [firstName, lastName].join(' ')

fullName(user.firstName, user.lastName)
// Bobby Fischer
```

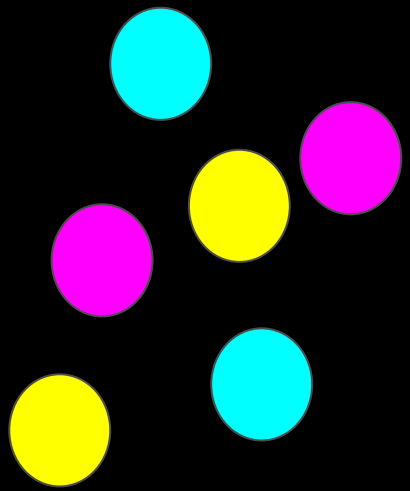
```
const user = {firstName: 'Bobby', lastName: 'Fischer'}
const joinWithSpace = (...args) => args.join(' ')

joinWithSpace(user.firstName, user.lastName)

joinWithSpace('a', 'b', 'c') // 'a b c'

joinWithSpace(joinWithSpace('a', 'b'), 'c') // 'a b c'
joinWithSpace('a', joinWithSpace('b', 'c')) // 'a b c'
```

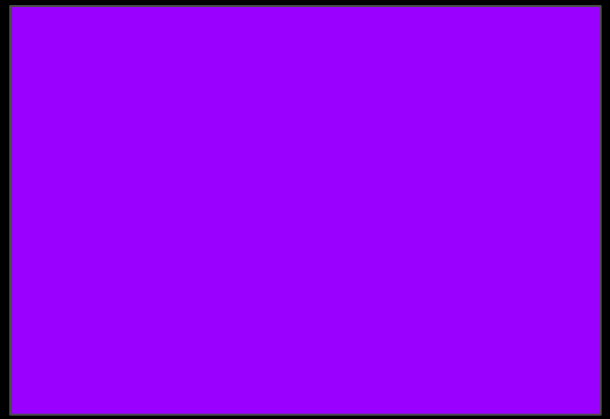
```
joinWithSpaces = joinable => joinable.join(' ')

joinWithSpaces([user.firstName, user.lastName])
```

```
const identity = a => a
```

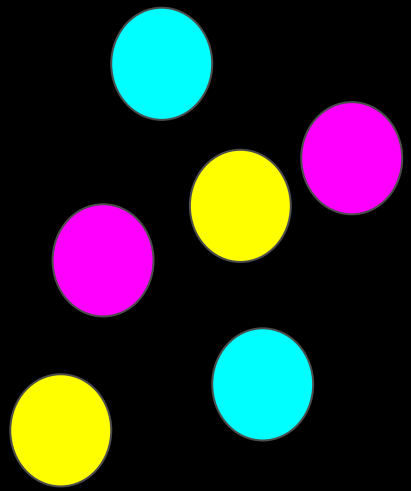
Highly generalized functions

Composition





Composition



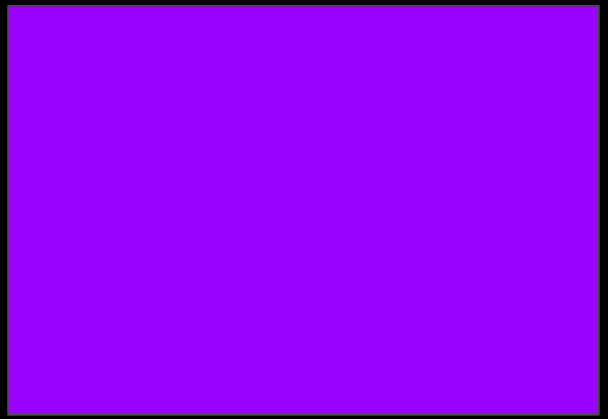
- Satisfy use cases
- Simple, understandable pieces
- Reuse

- Harder to change implementation
- Harder for user to compose

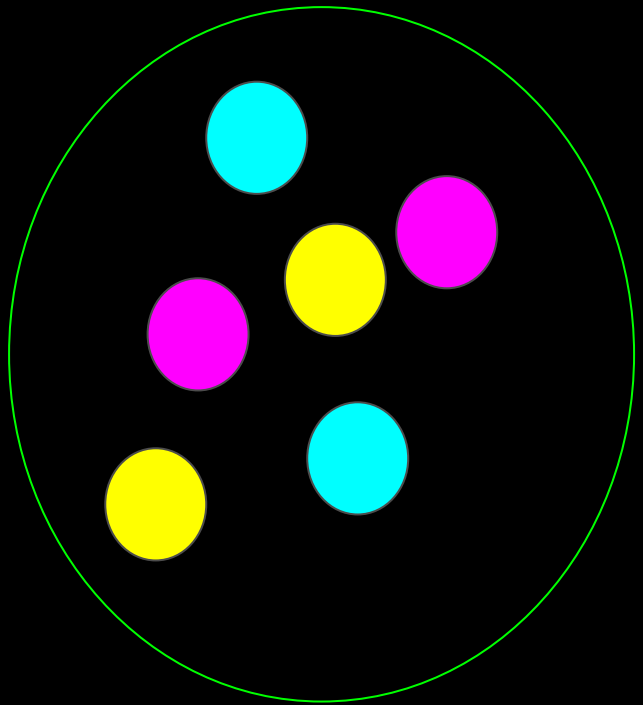
Composition

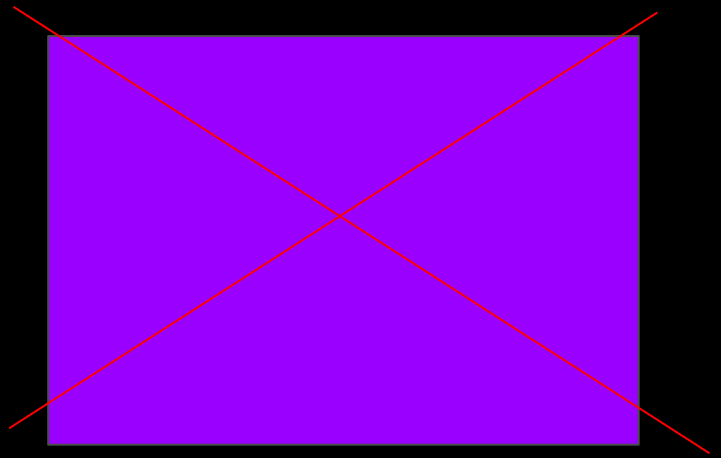
- Flexibility in implementation changes
- Less use cases to support

- Flags, if/else
- Won’t satisfy all cases
- Less reuse



Composition





Definition [edit]

A group is a set, G, together with an operation $\cdot$ (called the *group law* of G) that combines any two elements a and b to form another element, denoted $a \cdot b$ or ab. To qualify as a group, the set and operation, $(G, \cdot)$, must satisfy four requirements known as the *group axioms*:[5]

Closure

For all a, b in G, the result of the operation, $a \cdot b$, is also in G.[b]

Associativity

For all a, b and c in G, $(a \cdot b) \cdot c = a \cdot (b \cdot c)$.

Identity element

There exists an element e in G such that, for every element a in G, the equation $e \cdot a = a \cdot e = a$ holds. Such an element is unique
element.

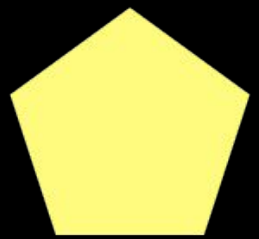
Inverse element

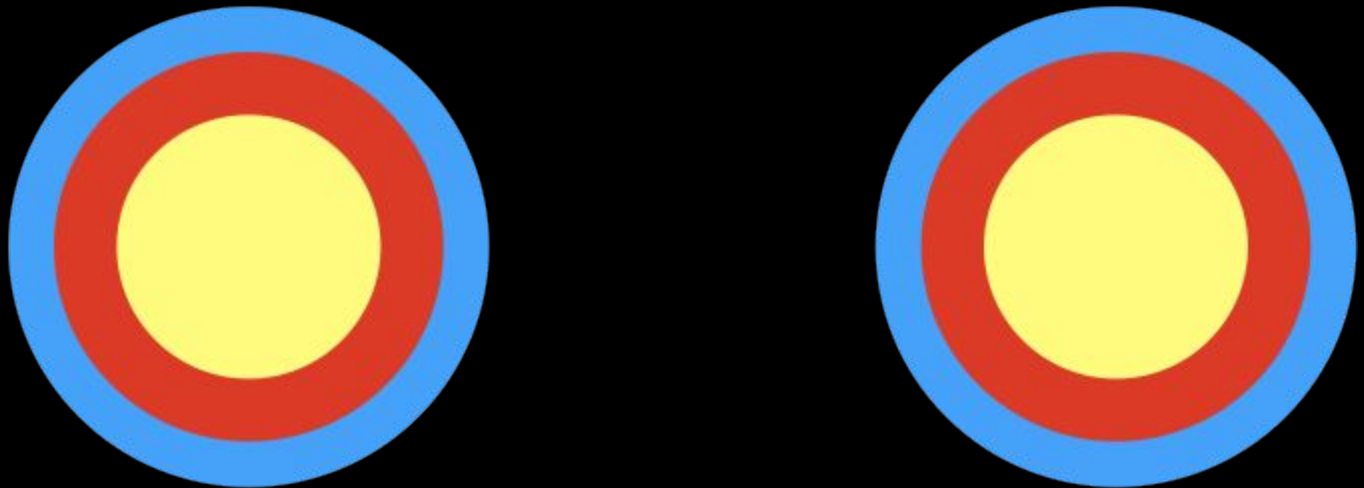
For each a in G, there exists an element b in G, commonly denoted a^{-1} (or $-a$, if the operation is denoted "+"), such that $a \cdot b = b \cdot$

Favor composable functions, mostly

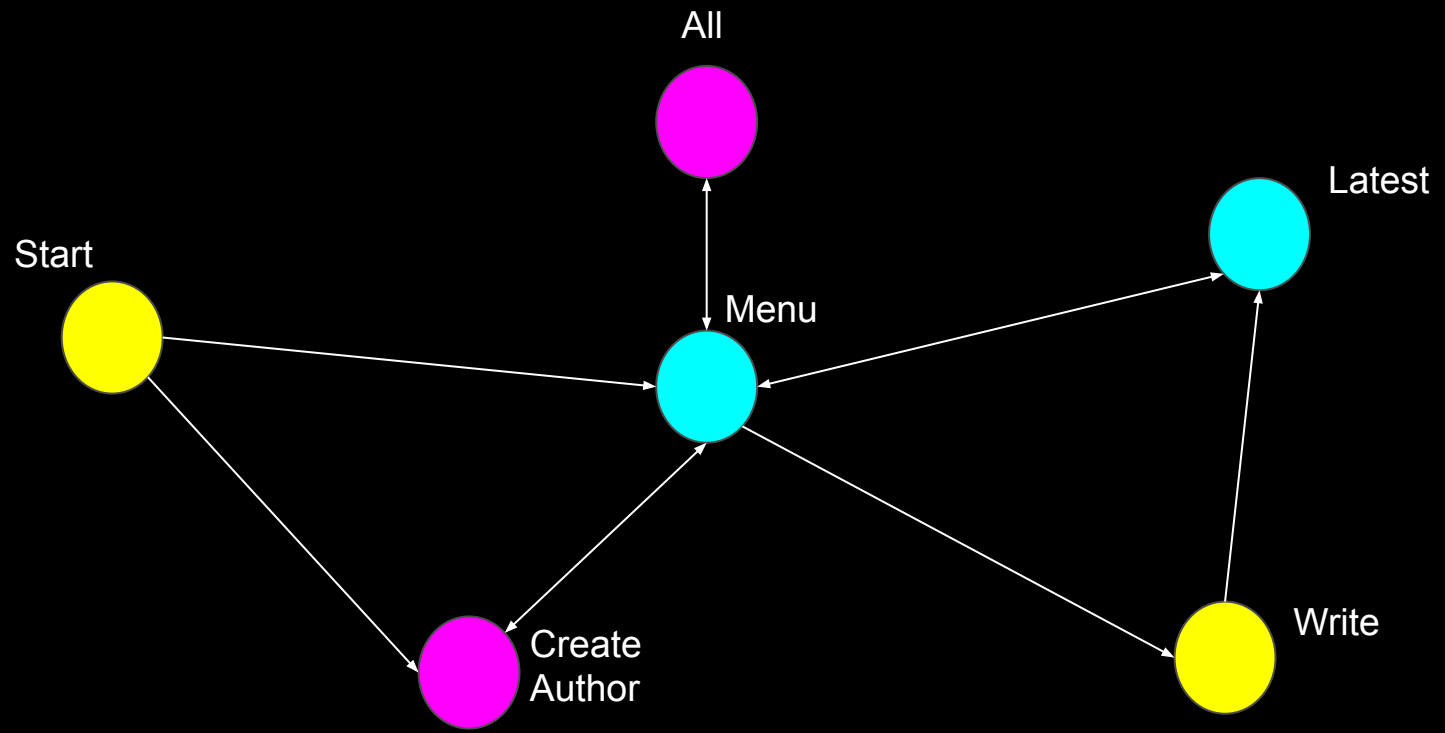






CLI blog



Exercises

- Monoid: https://codepen.io/drboolean/pen/MpKpee
- Modelling Fns: https://codepen.io/drboolean/pen/YZwrGK
- Monad Transformers: https://codepen.io/drboolean/pen/NQKByP

Code
https://drive.google.com/file/d/1XQr5SZvTJ7dFYChr5kV42zO2FMhSATOa/view?usp=sharing