ClojureScript

for the web

Michiel Borkent
@borkdude
Øredev, November 6th 2014

FINALIST
open IT oplossingen

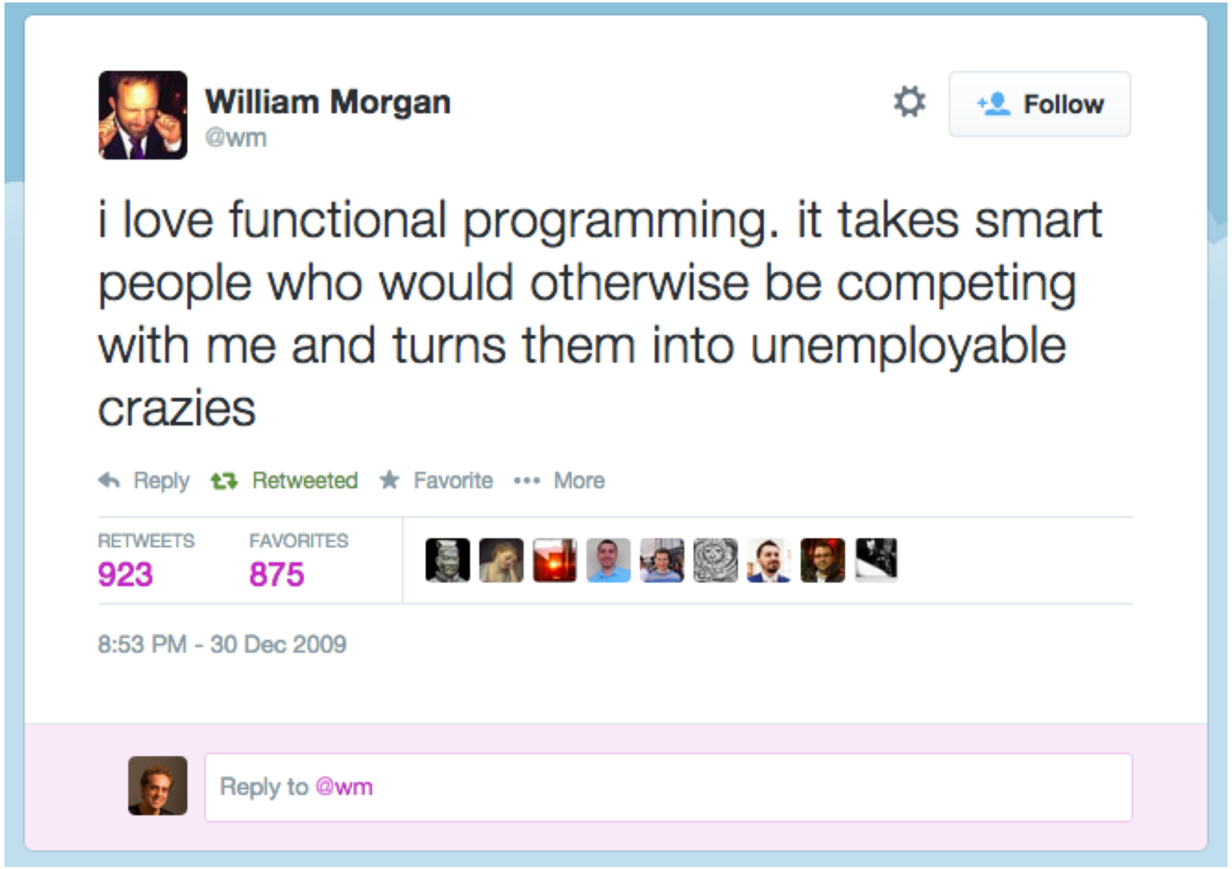
Michiel Borkent (@borkdude)

- Clojure(Script) developer at FINALIST open IT oplossingen
- Clojure since 2009
- Former lecturer, taught Clojure

Agenda

- Why ClojureScript?
- The Language
- The Ecosystem

Warning



William Morgan
@wm

Follow

i love functional programming. it takes smart people who would otherwise be competing with me and turns them into unemployable crazies

Reply Retweeted Favorite More

RETWEETS 923 FAVORITES 875

8:53 PM - 30 Dec 2009

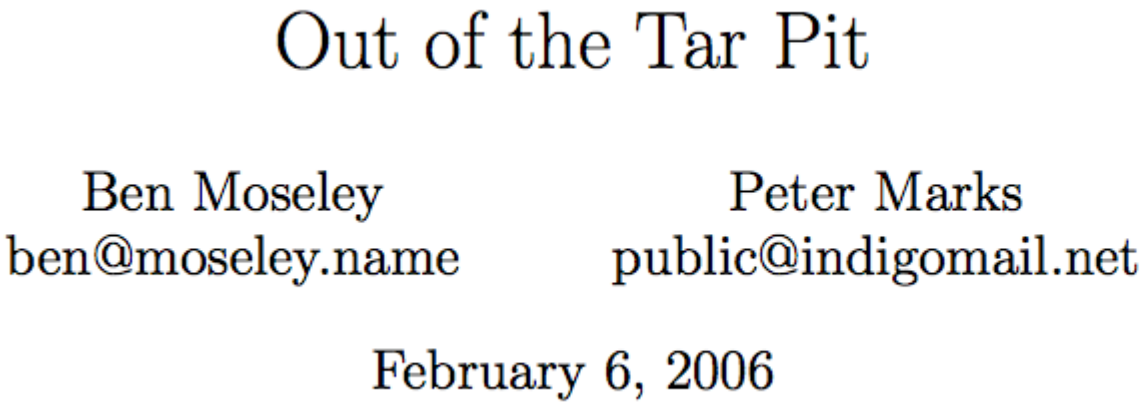
Reply to @wm

Why ClojureScript?

Current status

- JavaScript is everywhere, but not a robust and concise language - wat

  Requires discipline to only use "the good parts"
- JavaScript is taking over: UI logic from server to client
- JavaScript is not going away in the near future
- Advanced libraries and technologies exist to optimize JavaScript: (Google Closure, V8)



Out of the Tar Pit

Ben Moseley
ben@moseley.name

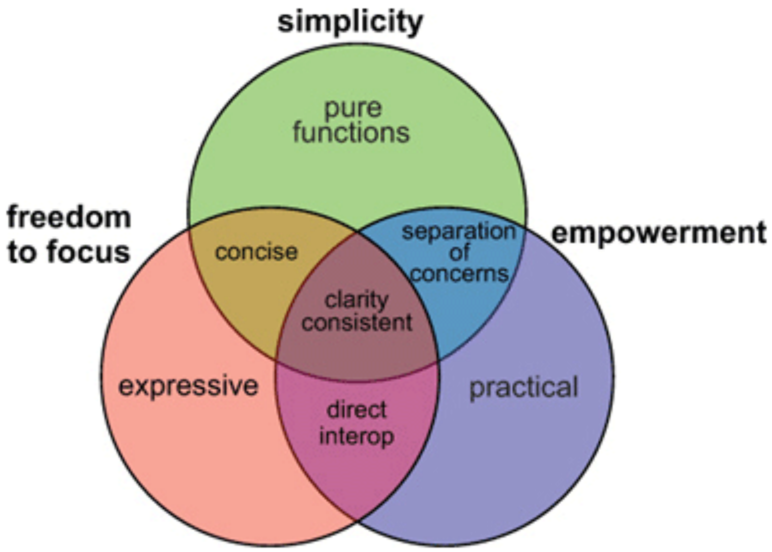
Peter Marks
public@indigomail.net

February 6, 2006

tl;dr:

- complexity is biggest problem in software
- mutability + control: more state, more complexity
- immutability + FP: less state, less complexity

Clojure(Script) promotes



source: http://www.drdobbs.com/architecture-and-design/the-clojure-philosophy/240150710

ClojureScript?

- Released June 20th 2011
- Client side story of Clojure ecosystem
- Serves Clojure community:

  50%* of Clojure users also use ClojureScript

  93%** of ClojureScript users also use Clojure

- ClojureScript targets JavaScript by adopting Google Closure
  - libraries: `goog.provide/require` etc.
  - optimization: dead code removal

*http://cemerick.com/2013/11/18/results-of-the-2013-state-of-clojure-clojurescript-survey/
** http://blog.cognitect.com/blog/2014/10/24/analysis-of-the-state-of-clojure-and-clojurescript-survey-2014

The Language

Such parens...

```
f(x)  ->     (f x)
```

JavaScript - ClojureScript

`no implementation`	`(ns my.library`
	`  (:require [other.library :as other]))`

`var foo = "bar";`	`(def foo "bar")`

`// In JavaScript`
`// locals are mutable`
 	
`function foo(x) {`
`  x = "bar";`
`}`
	`;; this will issue an error`
	
	`(defn foo [x]`
	`  (set! x "bar"))`

source: http://himera.herokuapp.com/synonym.html

JavaScript - ClojureScript

```javascript
if (bugs.length > 0) {
  return 'Not ready for release';
} else {
  return 'Ready for release';
}
```

```clojure
(if (pos? (count bugs))
  "Not ready for release"
  "Ready for release")
```

```javascript
var foo = {bar: "baz"};
foo.bar = "baz";
foo["abc"] = 17;
```

```clojure
(def foo (js-obj "bar" "baz"))
(set! (.-bar foo) "baz")
(aset foo "abc" 17)
```

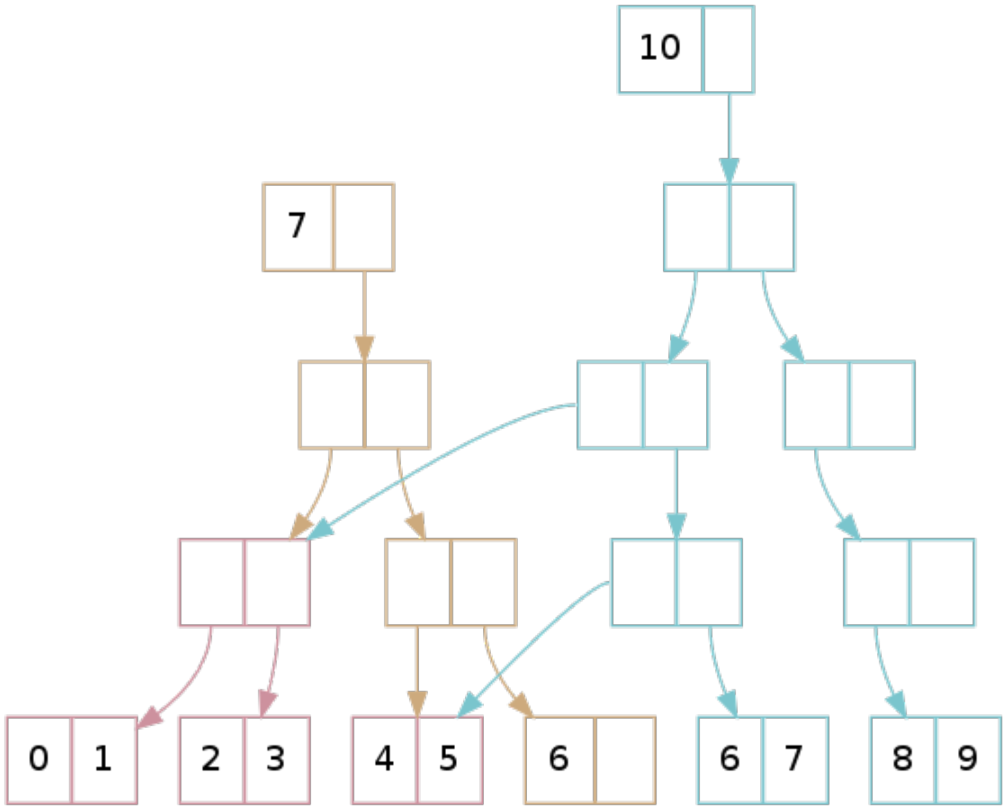
source: http://himera.herokuapp.com/synonym.html

Core language features

- persistent immutable data structures
- functional programming
- sequence abstraction
- isolation of mutable state (atoms)
- Lisp: macros, REPL
- core.async

Persistent data structures

```clojure
(def v (vector))
(def v [])
(def v [1 2 3])
(conj v 4) ;; => [1 2 3 4]
(get v 0) ;; => 1
(v 0) ;; => 1
```



source: http://hypirion.com/musings/understanding-persistent-vector-pt-1

Persistent data structures

```
(def m (hash-map))
(def m {})
(def m {:foo 1 :bar 2})
(conj m [:baz 3])
;; => {:foo 1 :bar 2 :baz 3}
(assoc m :foo 2) ;; => {:foo 2 :bar 2}
(get m :foo) ;;= > 2
(m :foo) ;;= > 2
(dissoc m :foo) ;;=> {:bar 2}
```

Functional programming

```
(def r (->>
         (range 10)     ;; (0 1 2 .. 9)
         (filter odd?)  ;; (1 3 5 7 9)
         (map inc)))    ;; (2 4 6 8 10)
;; r is (2 4 6 8 10)
```

Functional programming

```
;; r is (2 4 6 8 10)
(reductions + r)
;; => (2 6 12 20 30)
(reduce + r)
;; => 30
```

Sequence abstraction

Data structures as seqs

```
(first [1 2 3]) ;;=> 1
(rest [1 2 3]) ;;=> (2 3)
```

General seq functions: `map`, `reduce`, `filter`, ...

```
(distinct [1 1 2 3]) ;;=> (1 2 3)
(take 2 (range 10)) ;;=> (0 1)
```

See http://clojure.org/cheatsheet for more

Sequence abstraction

Most seq functions return lazy sequences:

```
(take 2 (map
            (fn [n] (js/alert n) n)
              (range)))
```

side effect

infinite lazy sequence of numbers

Isolation of state

one of possible pre-React patterns

function called from event handler

new todo

```
(def app-state (atom []))

(declare rerender)

(add-watch app-state ::rerender
           (fn [k a o n]
             (rerender o n)))


(defn add-todo [text]
  (let [tt (.trim text)]
    (if (seq tt)
      (swap! app-state conj
             {:id (get-uuid)
              :title tt
              :completed false}))))
```

adapted from: https://github.com/dfuenzalida/todo-cljs

Lisp: macros

```
(map inc
  (filter odd?
    (range 10))))
```

```
(->>
  (range 10)
  (filter odd?)
  (map inc))
```

thread last macro

Lisp: macros

```
(macroexpand
  '(->> (range 10) (filter odd?)))

;; => (filter odd? (range 10))

(macroexpand
  '(->> (range 10) (filter odd?) (map inc)))

;; => (map inc (filter odd? (range 10)))
```

Lisp: macros

JVM Clojure:

```
(defmacro defonce [x init]
 `(when-not (exists? ~x)
    (def ~x ~init)))
```

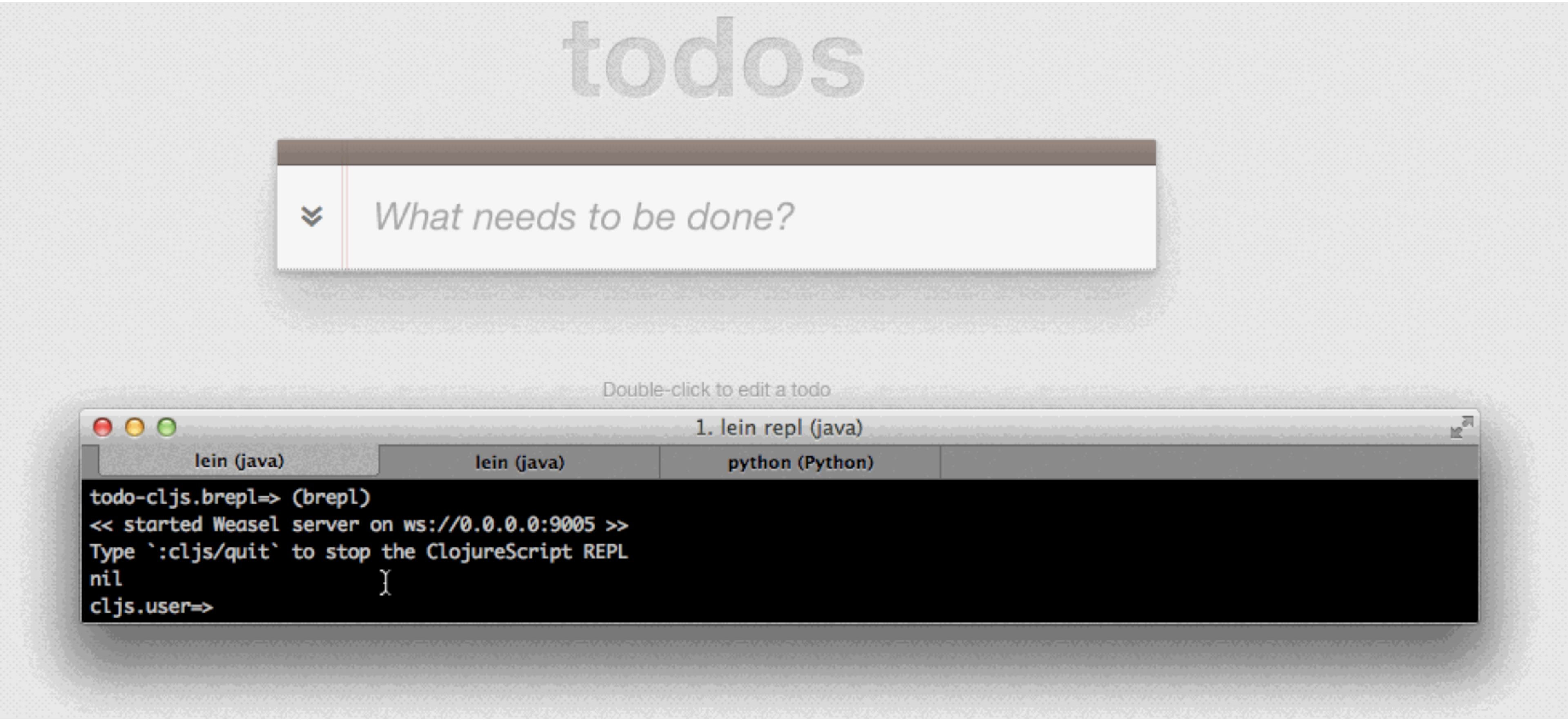
ClojureScript:

```
(defonce foo 1)
(defonce foo 2) ;; no effect
```

notes:

- macros must be written in JVM Clojure
- are expanded at compile time
- generated code gets executes in ClojureScript

LISP: Browser REPL (weasel)



```
todo-cljs.brepl=> (brepl)
<< started Weasel server on ws://0.0.0.0:9005 >>
Type `:cljs/quit` to stop the ClojureScript REPL
nil
cljs.user=>
```

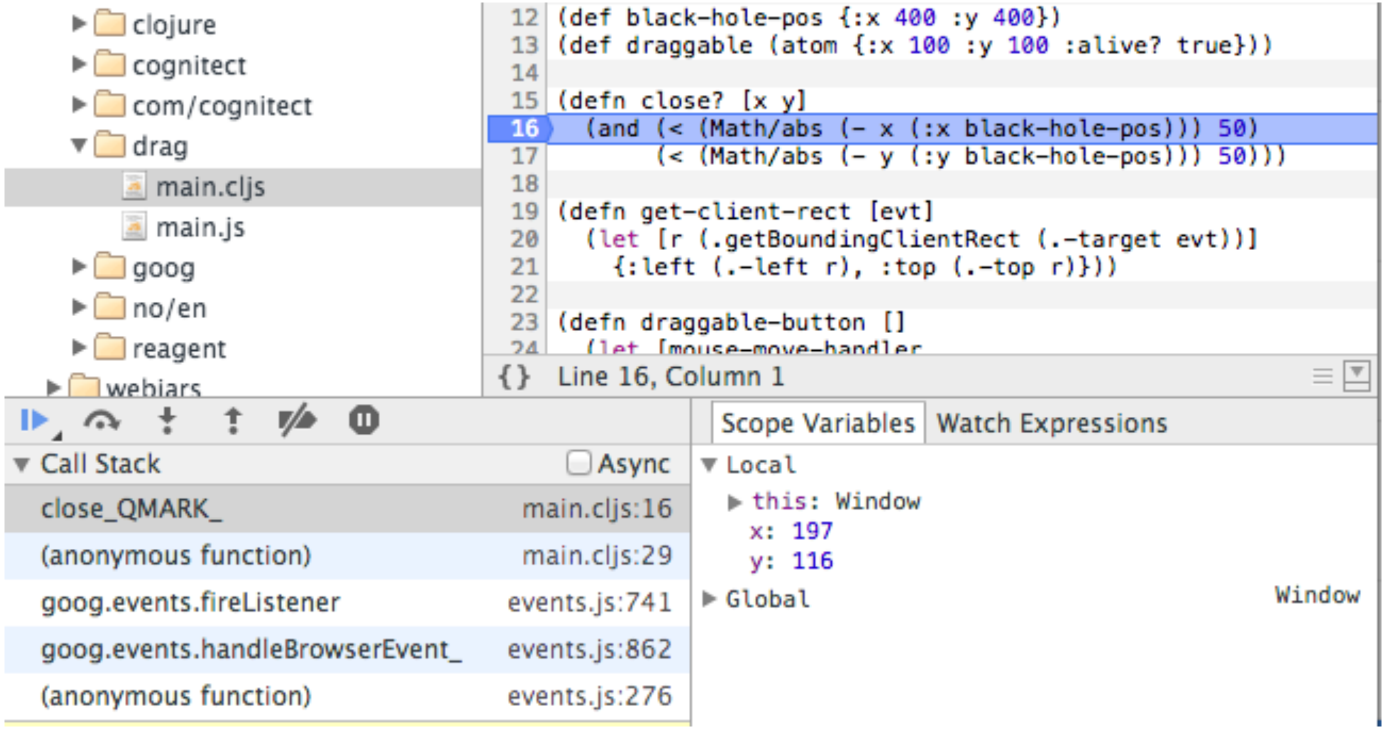
core.async

```
(def ch (chan))

(go (loop []
      (if-let [msg (<! ch)]
        (do
          (.log js/console msg)
          (recur))
        (println "terminating loop..."))))

(events/listen (by-id "button1") EventType.CLICK
               #(put! ch "hello world!"))

(events/listen (by-id "button2") EventType.CLICK
               #(close! ch))
```

The Ecosystem

Debugging

Source maps let you debug ClojureScript directly from the browser



```clojure
(def black-hole-pos {:x 400 :y 400})
(def draggable (atom {:x 100 :y 100 :alive? true}))

(defn close? [x y]
  (and (< (Math/abs (- x (:x black-hole-pos))) 50)
       (< (Math/abs (- y (:y black-hole-pos))) 50)))

(defn get-client-rect [evt]
  (let [r (.getBoundingClientRect (.-target evt))]
    {:left (.-left r), :top (.-top r)}))

(defn draggable-button []
  (let [mouse-move-handler
```

Line 16, Column 1

Call Stack | Async

```
close_QMARK_                        main.cljs:16
(anonymous function)                main.cljs:29
goog.events.fireListener            events.js:741
goog.events.handleBrowserEvent_     events.js:862
(anonymous function)                events.js:276
```

Scope Variables | Watch Expressions

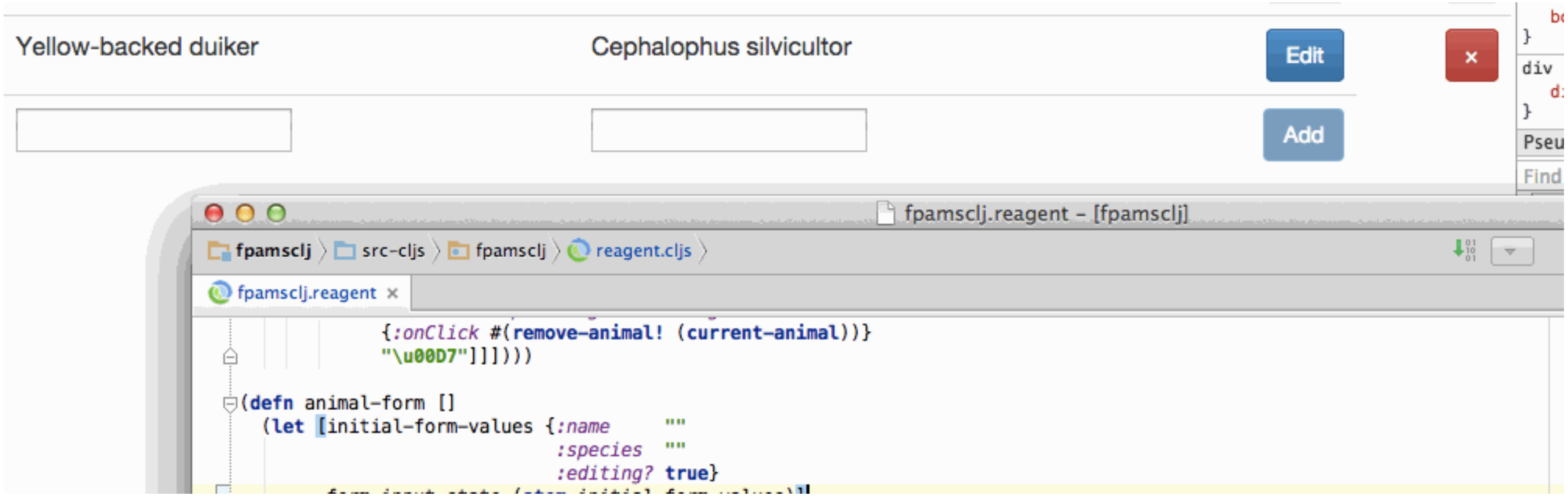
```
▼ Local
  ▶ this: Window
    x: 197
    y: 116
▶ Global                     Window
```

Leiningen

- Used by 98% of Clojure users
- Clojure's Maven
- Managing dependencies
- Running a REPL
- Packaging and deploying
- Plugins:
    - lein cljsbuild
    - lein figwheel

```clojure
(defproject example "0.1.0-SNAPSHOT"
  :description "FIXME: write this!"
  :url "http://example.com/FIXME"

  :dependencies [[org.clojure/clojure "1.6.0"]
                 [org.clojure/clojurescript "0.0-2311"]]

  :plugins [[lein-cljsbuild "1.0.4-SNAPSHOT"]]

  :source-paths ["src"]

  :cljsbuild {:builds [{:id "example"
                        :source-paths ["src"]
                        :compiler {
                                   :output-to "example.js"
                                   :output-dir "out"
                                   :optimizations :none
                                   :source-map true}}]})
```

figwheel: live code reloading

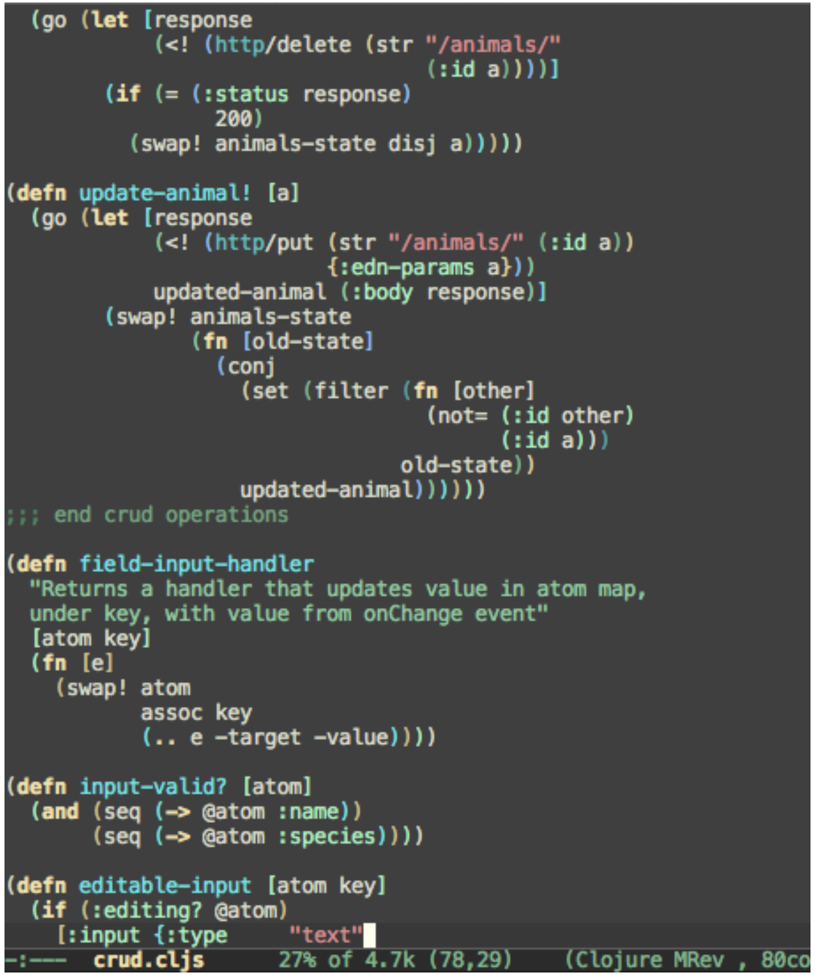


```
            {:onClick #(remove-animal! (current-animal))}
            "\u00D7"]]])))

(defn animal-form []
  (let [initial-form-values {:name     ""
                             :species  ""
                             :editing? true}
```

Editors

Most popular:

- Emacs
- Cursive Clojure (IntelliJ)
- Vim + vim-fireplace
- Light Table
- Counterclockwise (Eclipse)



```
  (go (let [response
            (<! (http/delete (str "/animals/"
                                  (:id a))))]
        (if (= (:status response)
                 200)
          (swap! animals-state disj a)))))

(defn update-animal! [a]
  (go (let [response
            (<! (http/put (str "/animals/" (:id a))
                          {:edn-params a}))
            updated-animal (:body response)]
        (swap! animals-state
               (fn [old-state]
                 (conj
                   (set (filter (fn [other]
                                  (not= (:id other)
                                        (:id a)))
                                old-state))
                   updated-animal))))))
;;; end crud operations

(defn field-input-handler
  "Returns a handler that updates value in atom map,
  under key, with value from onChange event"
  [atom key]
  (fn [e]
    (swap! atom
           assoc key
           (.. e -target -value))))

(defn input-valid? [atom]
  (and (seq (-> @atom :name))
       (seq (-> @atom :species))))

(defn editable-input [atom key]
  (if (:editing? @atom)
    [:input {:type     "text"
-:---  crud.cljs       27% of 4.7k (78,29)    (Clojure MRev , 80co
```

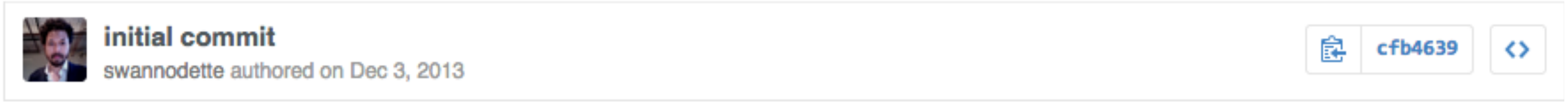
cljs.core.typed

```
(ns foo)

(ann parse-int [string -> number])

(defn parse-int [s]
  (js/parseInt s))

(parse-int 3)
```

```
Function foo/parse-int could not be
applied to arguments:

Domains:
  string

Arguments:

(clojure.core.typed/Val 3)

Ranges:
  number

in: (foo/parse-int 3)
```

ClojureScript interfaces to React

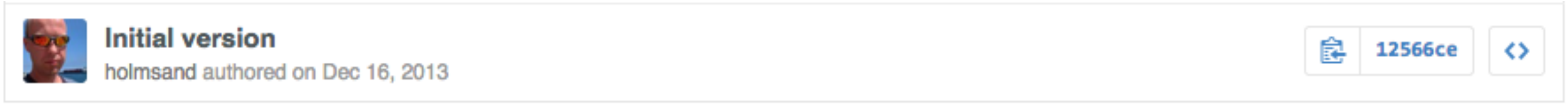
Talk today @ 17:40-18:20



initial commit

swannodette authored on Dec 3, 2013

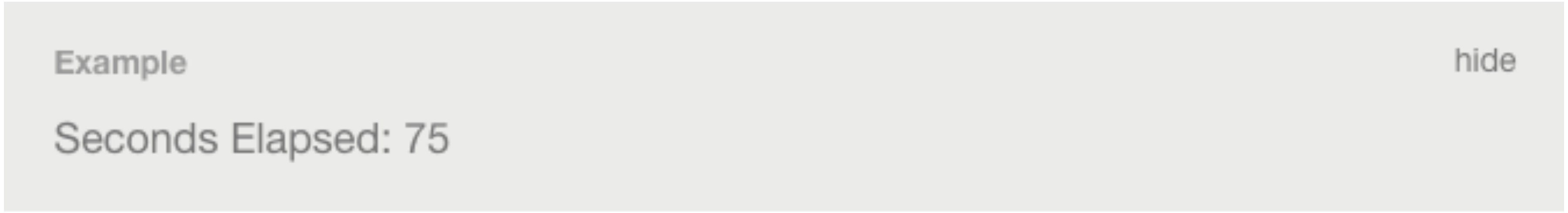
cfb4639



Initial version

holmsand authored on Dec 16, 2013

12566ce


Example

hide

Seconds Elapsed: 75

```
(defn timer-component []
  (let [seconds-elapsed (atom 0)]
    (fn []
      (js/setTimeout #(swap! seconds-elapsed inc) 1000)
      [:div
       "Seconds Elapsed: " @seconds-elapsed])))
```

Community

Google Groups

IRC: #clojure and #clojurescript on freenode

Planet Clojure

Reddit

Meetup.com

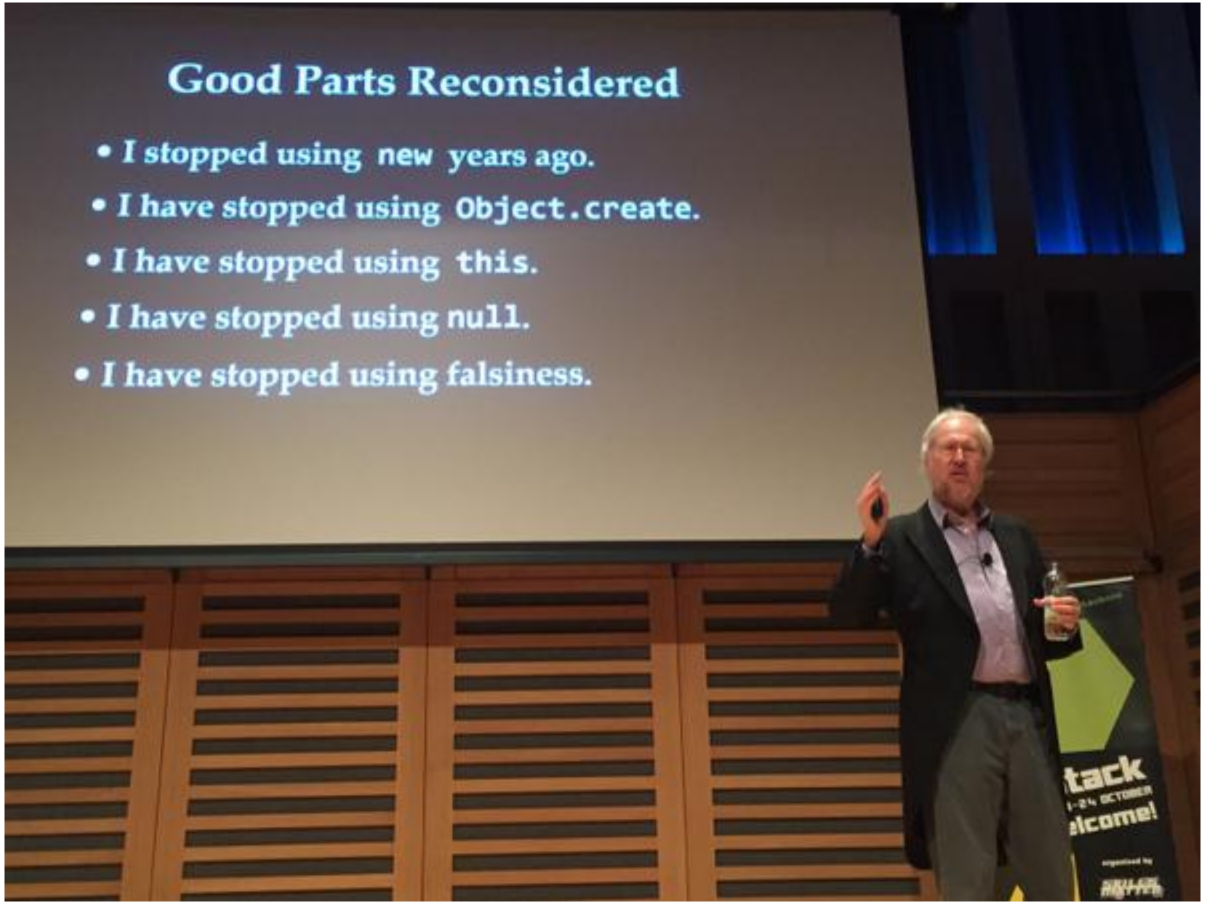
Interesting libraries

- cljs-http: ajax + core.async
- cljx: code sharing between clj and cljs
- clojurescript.test: unit testing
- dommy: dom manipulation
- crate: hiccup style HTML templating
- sente: websockets + core.async
- transit: conveying values between languages
- datascript: functional database in cljs
- garden: css generation from Clojure

Thank you!

https://github.com/borkdude/oredev2014

Trash can

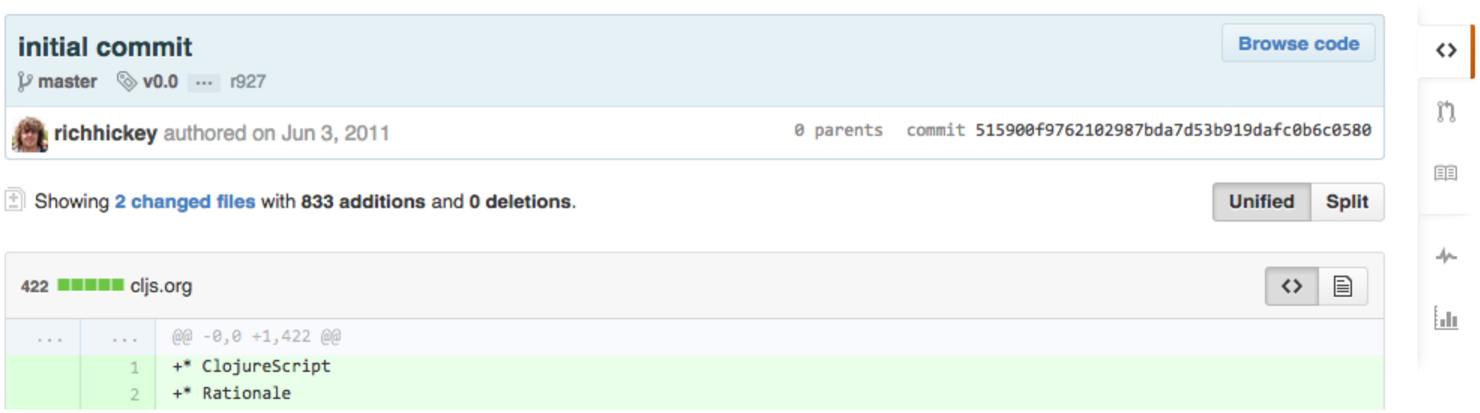


Good Parts Reconsidered

- I stopped using `new` years ago.
- I have stopped using `Object.create`.
- I have stopped using `this`.
- I have stopped using `null`.
- I have stopped using falsiness.

Brief history of ClojureScript

June 20th 2011: first release of ClojureScript



initial commit

master v0.0 ... r927

richhickey authored on Jun 3, 2011 0 parents commit 515900f9762102987bda7d53b919dafc0b6c0580

Showing 2 changed files with 833 additions and 0 deletions.

422 cljs.org

```
@@ -0,0 +1,422 @@
+* ClojureScript
+* Rationale
```

Brief history of ClojureScript

Early 2012: first release of lein cljsbuild

Leiningen plugin to make ClojureScript development easy

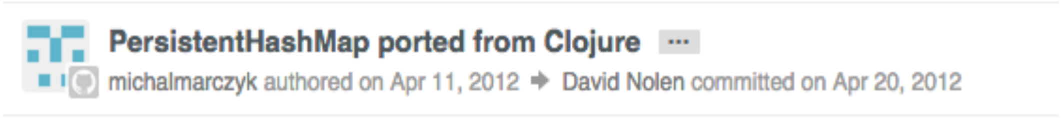
98% of Clojure users use Leiningen

Possible optimization levels include
`:whitespace` removes comments and whitespace
`:simple` renames local variables to compress JavaScript
`:advanced`: agressively renames and strips away unused

Brief history of ClojureScript

April 2012:

persistent data structures were ported



PersistentHashMap ported from Clojure ···

michalmarczyk authored on Apr 11, 2012 → David Nolen committed on Apr 20, 2012

Light Table

June 2012

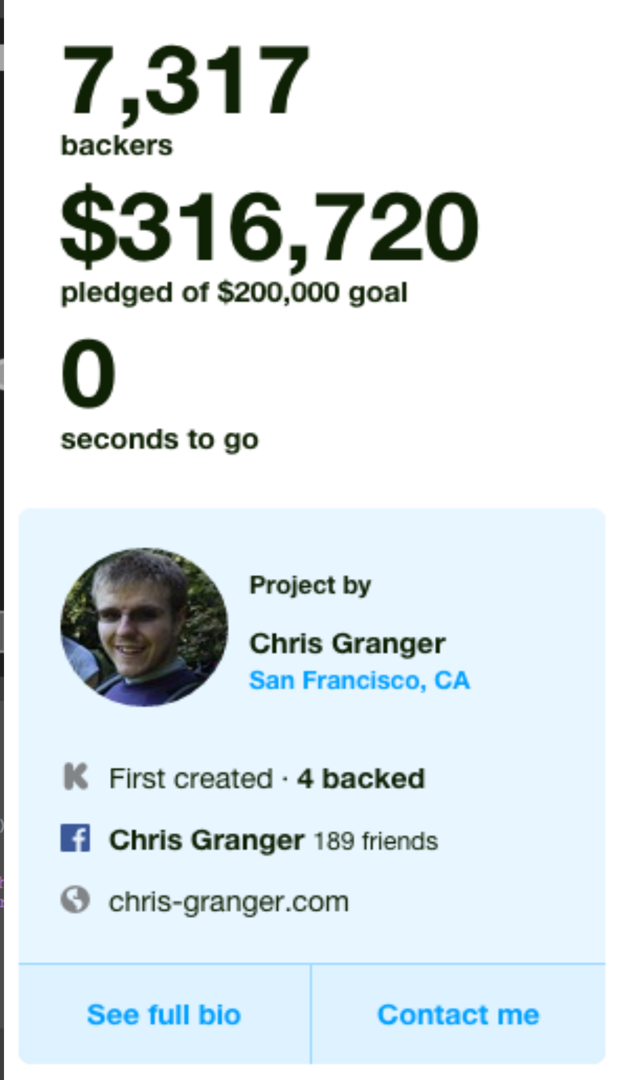
Funded as Kickstarter Project

Interactive, experimental IDE written in ClojureScript, running on Node Webkit

Became open source early 2014

```
(defn move [me]
  (let [speed 5
        vx (cond
             (input? :left) (- speed)
             (input? :right) speed
             :else 0)
        moved (update-in me [:x] + vx)]
    (if (zero? vx)
      me
      (if-let [block (colliding? moved)]
        (let [block-edge (if (< vx 0)
                           (+ (:x block) (:w block) (:r me))
                           (- (:x block) (:r me)))]

          (assoc me :x block-edge))
        moved))))
```

```
(defn gravity [{:keys [vy y] :as me}]
  (let [g 0.5
        vy (or vy 0)
        neue-vy (+ vy g)
        dir (if (< neue-vy 0) :up :down)
        moved (update-in me [:y] + neue-vy)
    (if-let [block (colliding? moved)]
      (let [block-edge (if (= dir :up)
                         (+ (:y block) (:h
                         (- (:y block) (:r
        (assoc me :y block-edge
                  :jumping (= dir :up)
                  :vy 0))
      (-> moved
          (assoc :vy neue-vy)))))
```



7,317
backers

$316,720
pledged of $200,000 goal

0
seconds to go

Project by

Chris Granger
San Francisco, CA

First created · **4 backed**

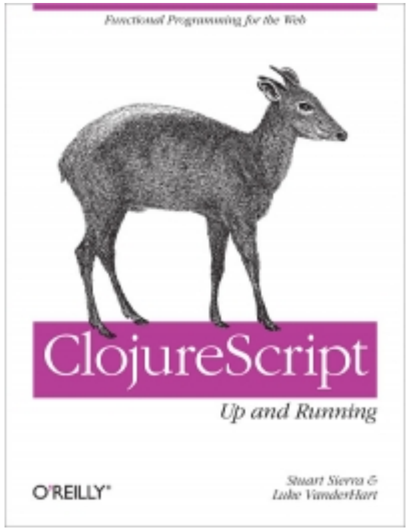
Chris Granger 189 friends

chris-granger.com

See full bio | Contact me

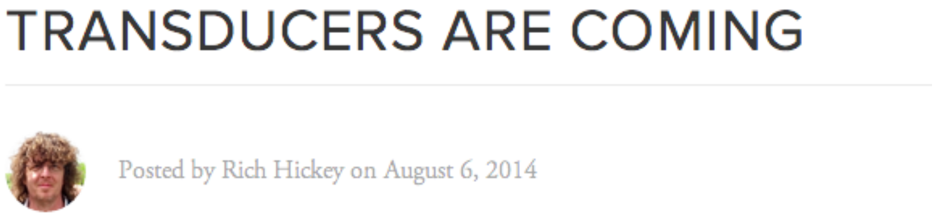
Brief history of ClojureScript

October 2012: ClojureScript Up and Running - O'Reilly



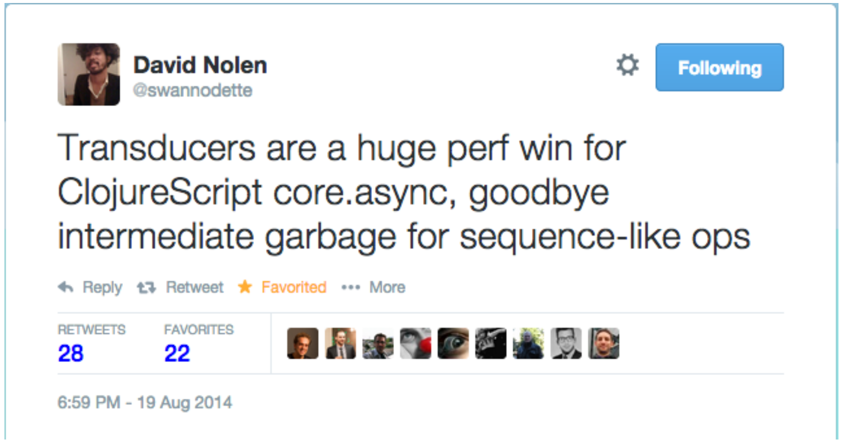
Brief history of ClojureScript

August 2014



TRANSDUCERS ARE COMING

Posted by Rich Hickey on August 6, 2014



David Nolen
@swannodette

Transducers are a huge perf win for ClojureScript core.async, goodbye intermediate garbage for sequence-like ops

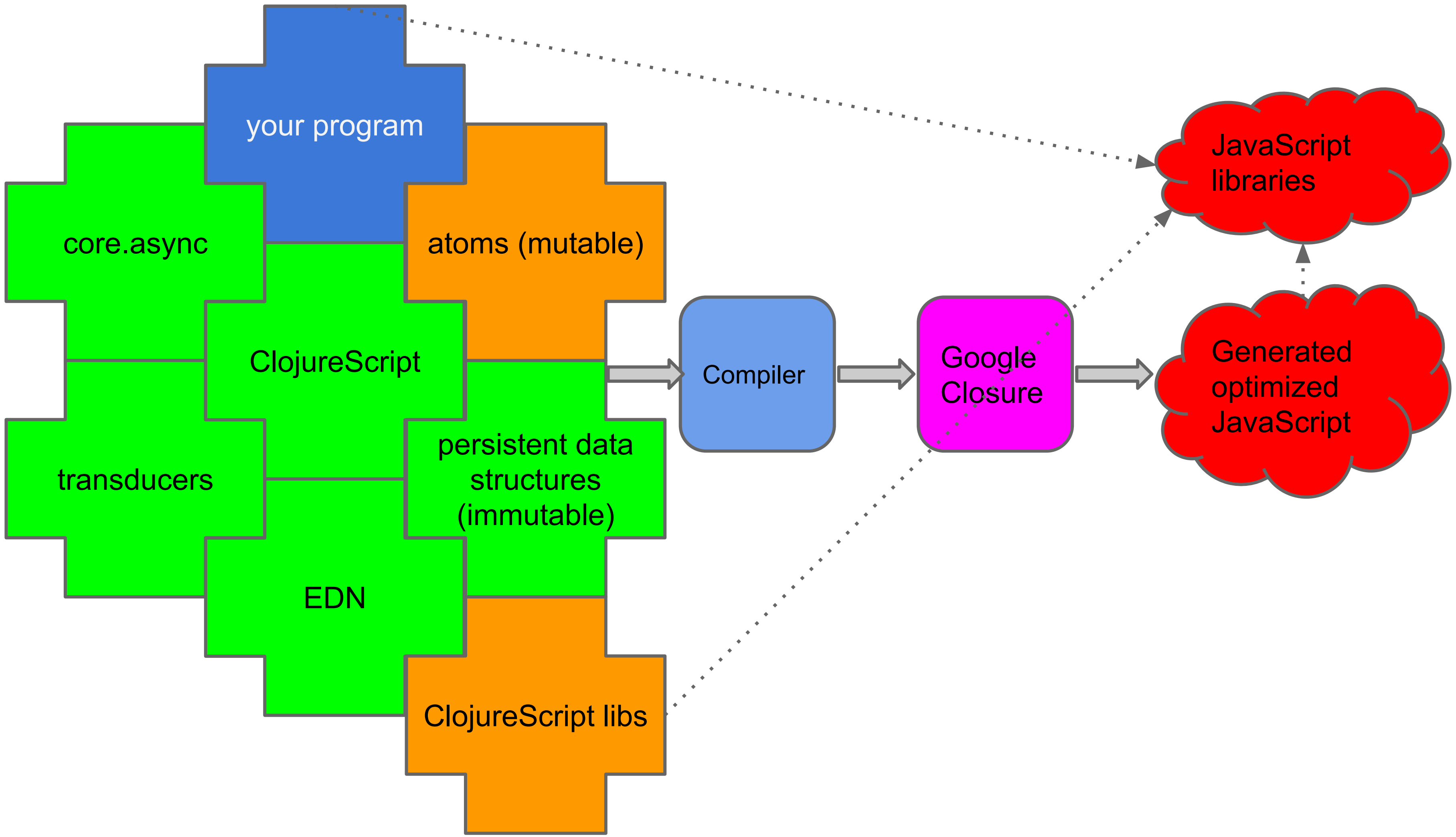
RETWEETS 28
FAVORITES 22

6:59 PM - 19 Aug 2014

Transducers

```
(->>
  (range 10)
  (filter odd?)
  (map inc))
```

```
(def xform
  (comp
    (filter odd?)
    (map inc)))

;; lazy
(sequence xform
          (range 10))

;; strict
(into [] xform (range 10))
```


your program
core.async
atoms (mutable)
ClojureScript
transducers
persistent data structures (immutable)
EDN
ClojureScript libs
Compiler
Google Closure
JavaScript libraries
Generated optimized JavaScript

Lisp: macros

```
(if (< x 5)
   :foo
   (if (> x 10)
     :bar
     :baz))
```

```
(cond (< x 5)   :foo
      (> x 10)  :bar
      :else     :baz)
```

cond macro

Frameworks

- Pedestal
- Hoplon
- Luminus (curated collection of libs)