Clojure in 10 Minutes

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What is Clojure?

- Lisp
- Functional Programming
- Immutable, persistent data structures
- Software Transactional Memory
- Object-oriented (sort of)
- Macros
- Managed code: JVM and CLR

Clojure is the future!
-- Uncle Bob

Getting off the Lisp Island

Syntax and Data Types

```
; This is a comment, semicolon is similar to // in C# / Java

;; List is the most common data structure
'(1 2 3)

;; Vector is a list that is indexable by position
[1 2 3]

;; Maps are associative data structures
{:key "value", :id 42}

;; Sets are mathematical sets
#{1 2 3}

;; Expressions are lists of form (function arg-1 arg-2 ...)
(println "Hello, World")
(+ 1 2 3)
```

List

Vector

Map

Set

Expression

file: core.clj

Clojure Basics

```clojure
(def answer 42)

(defn double-up [x]
  (* 2 x))

(defn max [a b]
  (if (< a b)
    b
    a))

(defn factorial [x]
  (reduce * 1 (range 1 (inc x))))
```

```clojure
;; List comprehension
(for [x (range 3)]
  (str "Element " x))
```

Incidentally this could also have been a modem connect string

```clojure
(letfn [(!-?> [&$ &!](if(>,&!,1)(!-?>@(->>,&$,(*,&!)ref)(->,&!,dec))&$))](!-?>,1,5))
```

file: functional.clj

Functional Programming

```
(def my-list (list 1 2 3))
(def my-vec [10 20 30])
(def my-map {:clojure "Rich", :perl "Larry", :python "Guido", :ruby "Matz"})
(def my-set #{:a :b :c})
```

```
;; Seq operations
(first my-list)
(rest my-vec)
(conj my-list "a" "b" "c")
(cons "CAR" my-list)
```

```
;; Map operations
(keys my-map)
(vals my-map)
(assoc my-map :c++ "Bjarne")
```

```
;; Higher-order functions
(map double-up my-vec)
(reduce + 0 my-list)
(filter even? my-list)
(remove even? my-list)
(sort-by :name [{:id 1, :name "Anders"} {:id 2, :name "Bjarne"}])
```

file: functional.clj

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Simple and Concise

```
public class StringUtils {
  public static boolean isBlank(String str) {
    int strLen;
    if (str == null || (strLen = str.length()) == 0) {
      return true;
    }
    for (int i = 0; i < strLen; i++) {
            if ((Character.isWhitespace(str.charAt(i)) == false)) {
              return false;
            }
    }
    return true;
  }
}
```

```
(defn blank? [s]
 (every? #(Character/isWhitespace %) s))
```

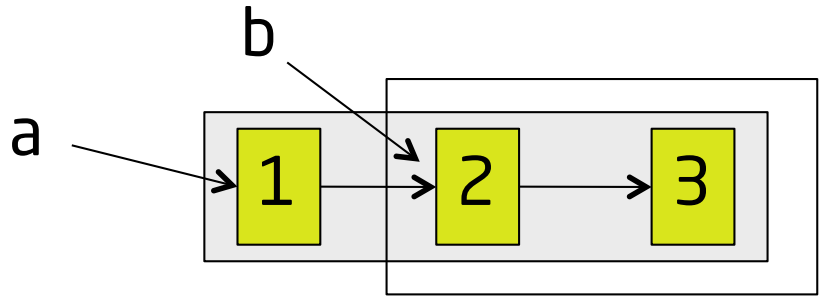
This makes my eyes hurt!

Source: Programming Clojure by Stuart Halloway (Pragmatic Programmers, 2009)

"State - you're doing it wrong"

- Immutable
- Persistent (struktural sharing, not copying)

```
(def a (list 1 2 3))
(def b (rest a))
```



- Simpler code
- Less concurrency issues

e.g. stable enumerations

STM - Software Transactional Memory

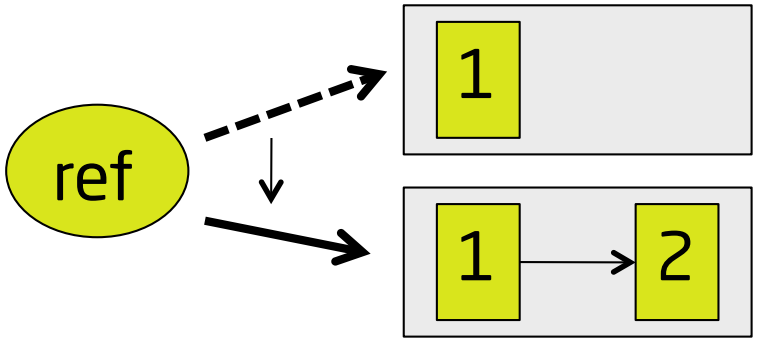
```
(defn post [account amount msg]
  (conj account {:amount amount, :msg msg}))

(defn transfer [from to amount msg]
  (dosync
   (alter from post (- amount) msg)
   (alter to post amount msg)))

(defn balance [account]
  (reduce + 0 (map :amount account)))


(deftest transfer-test
  (testing "Transfer between accounts."
    (let [a (ref [])
          b (ref [])]
      (transfer a b 10 "test")
      (is (= [{:amount -10, :msg "test"}] @a) "Money should be deducted from a")
      (is (= [{:amount 10, :msg "test"}] @b) "Money should be added to b"))))
```

concurrency-safe in-memory transactions!



file: stm.clj

Object Oriented with Protocols

```clojure
(defprotocol Price
  (price [x]))
(defprotocol Vat
  (vat [x]))

(defn price-with-vat [x]
  (+ (price x) (vat x)))

(defn standard-vat [x]
  (* (/ 25 100) (price x)))
```

```clojure
(defrecord menu-item [name price])
(def espresso (menu-item. "Espresso" 12))
(def cortado (menu-item. "Cortado" 16))
```

```clojure
(defrecord stamp [series name value])
(def iver (stamp.
           "Royal Danish Navy 500th Anniversary"
           "Iver Huitfeldt" 5.50))
```

```clojure
(extend-type menu-item
  Price
  (price [x] (:price x))
  Vat
  (vat [x] (standard-vat x)))
```

```clojure
(extend-type stamp
  Price
  (price [s] (:value s))
  Vat
  (vat [s] 0))
```

Open for extension,
closed for modification

```clojure
(price-with-vat espresso)
(vat iver)
```

file: oo.clj

Multi-methods

```
(defmulti type-info class)
(defmethod type-info String [x] (str "It is a String: " x))
(defmethod type-info menu-item [x] (str "It is a menu item!"))
(defmethod type-info :default [x] (str "It is a " (class x)))
```

Open-Closed Principle goodness

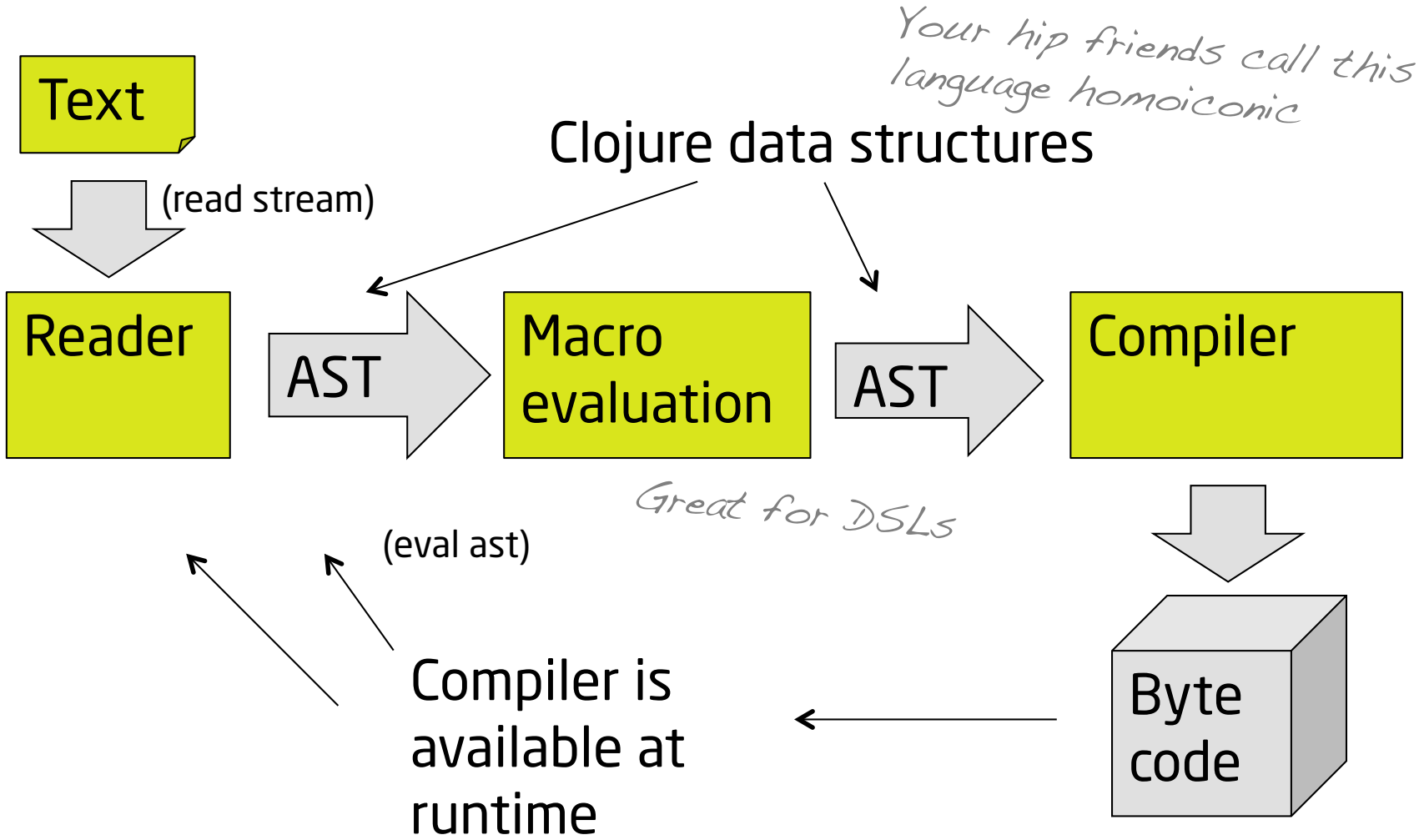
```
(defrecord menu-item [name type price])
(def espresso (menu-item. "Espresso" :drink 12))
(def cortado (menu-item. "Cortado" :drink 16))
(def burger (menu-item. "Burger Royale" :food 100))
```

Not your mother's dispatch

```
(defmulti description :type)
(defmethod description :drink [x]  (str "Drink a wonderful " (:name x)))
(defmethod description :food [x]   (str "Savour a tasty " (:name x)))
```

file: multi.clj

The Clojure Compiler



Example: Compojure web app

shorter than your web.config!

```
(ns hello-world
  (:use compojure.core, ring.adapter.jetty)
  (:require [compojure.route :as route]))

(defroutes main-routes
  (GET "/" [] "<h1>Hello World</h1>")
  (route/not-found "<h1>Page not found</h1>"))

(run-jetty main-routes {:port 8080})
```

Source: http://github.com/weavejester/compojure