SOURCE OF YOUR TECHNOLOGY

QL in Lisp (Clojure)

Rico Huijbers
Sioux Embedded Systems
rico.huijbers@sioux.eu

Why Clojure

- Perfect for (horizontal) DSLs
- I want a general purpose programming language that helps me raise the level of abstraction
- Selfish: learning a Lisp

QL

```
(defform box1-house-owning
      [boolean has-sold-house   "Did you sell a house in 2010?"]
      [boolean has-bought-house "Did you buy a house in 2010?"]
      [boolean has-maint-loan   "Did you enter a loan for
                                 maintenance/reconstruction?"]
      [group has-sold-house
         [currency selling-price "Price the house was sold for"]
         [currency private-debt  "Private debts for the sold
                                  house"]
         [calc value-residue (- selling-price private-debt)
                                 "Value residue"]]])
```

QL = pattern matching

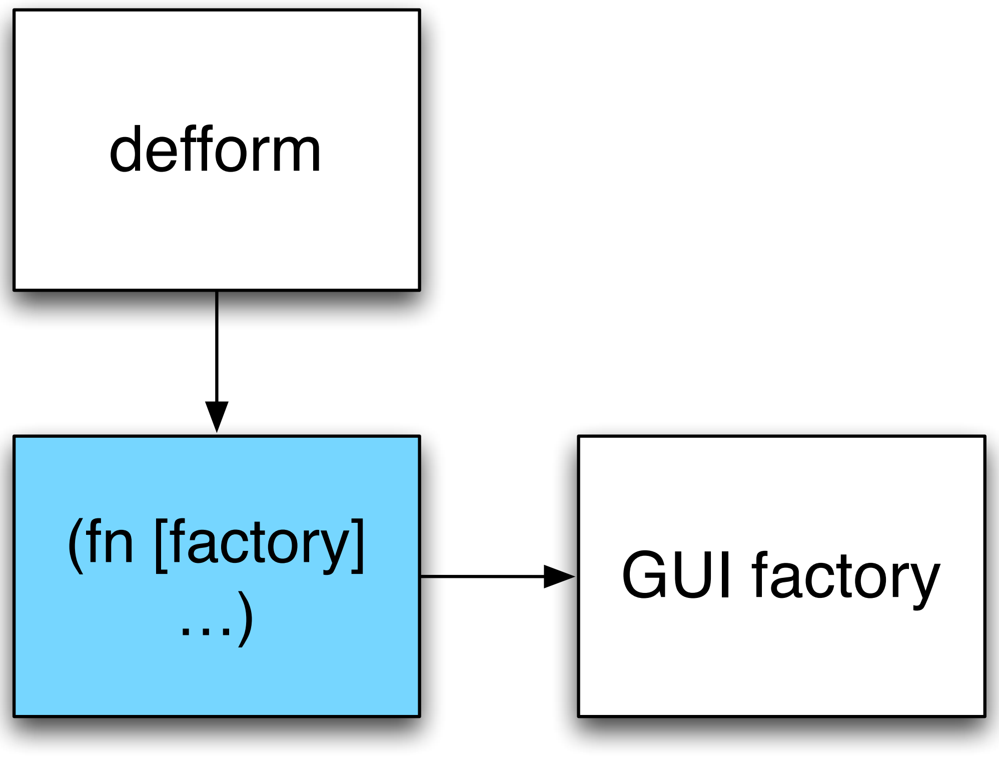
```
(defn create-elements [element gui-fact]

  (match [element]
         [['calc  name expr caption]]  `(output-element ...)
         [['group expr & subelements]] `(group-element ...)
         [[type   name caption]]       `(input-element ...)
         :else ...))
```

(Using a DSL called clojure.core.match)

QL implementation

- Generate a function that takes a factory which creates the UI
- Using a Swing DSL for creating the GUI (seesaw)



Expressions (1)

- First idea: completely reuse Clojure expressions
- Only thing that needs to be replaced is value lookup:

```
(- price debt)
```

$\longrightarrow$

```
(fn [lookup] (- (lookup 'price)
                (lookup 'debt)))
```

Expressions (2)

- We have the annoying “undefined” value, so we need to lift operators

```
(def operators
  {'+ (lift +)
   '- (lift -)
   ...
   })
```

```
(- price debt)
```

$\rightarrow$

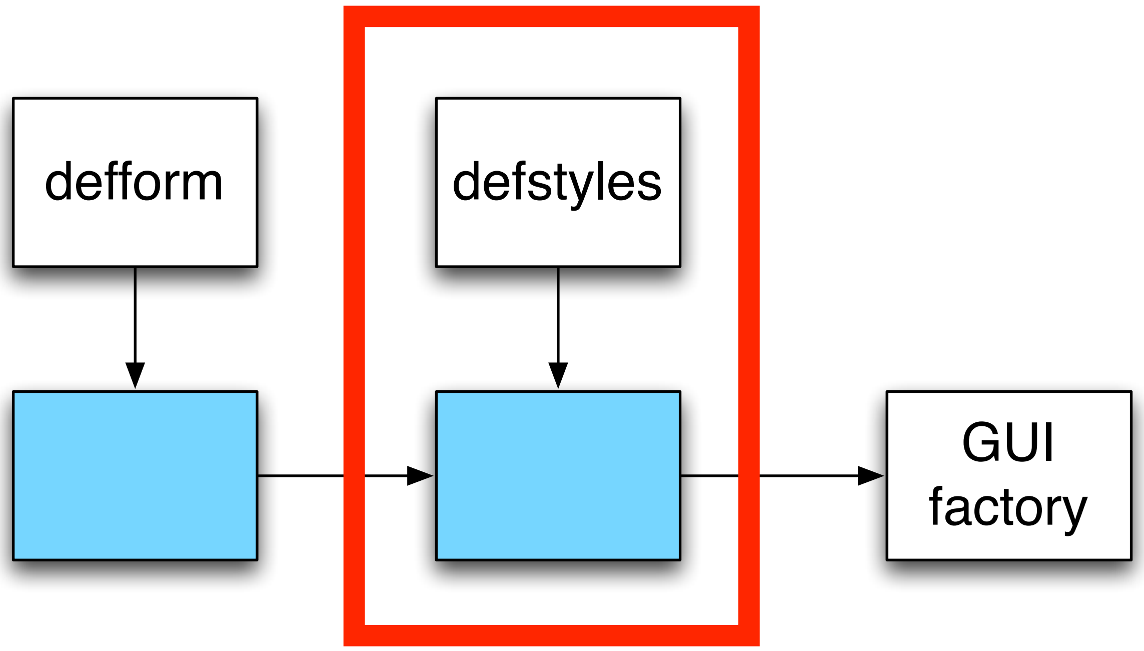
```
(fn [lookup] ((operators '-)
                (lookup 'price)
                (lookup 'debt)))
```

QLS Example

```
(defstyles some-style
           [has-sold-house {:type :radio-group}]
           [value-residue  {:label {:foreground "blue"}}]
           [twice          {:widget {:font {:size 20}}}])
```

QLS Design

- Values are arguments to Seesaw factory fuctions
- QLS macros are translated to GUI factory wrappers that add additional arguments



- Slight hack: requires passing the element name into the factory, (which it shouldn't need)

Validation

- Entirely “do it yourself!” ☺
- Currently:
  - Existence of variables in expressions
  - Circular dependencies
- Errors at compile time, not “live”

Clojure: The Good

- Definining DSLs is trivial: `defmacro`
  - Pattern matching
- Re-use is trivial: rewrite to other DSL
  - Seesaw
  - core.match
- Small: ~500 LoC

Clojure: The Bad

- Quoting Hell
  - Clojure has `:keyword`s, should have used those
- Dynamically typed, no tool support
  - Should have used Scala ☺
- Mostly functional, not a great fit with a state-oriented systems such as GUIs

Clojure: The Ugly

```
clojure.lang.Compiler$CompilerException: java.lang.IllegalArgumentException: Don't
know how to create ISeq from: Symbol, compiling:(questionnaire.clj:5)
 at clojure.lang.Compiler.analyze (Compiler.java:6281)
    clojure.lang.Compiler.access$100 (Compiler.java:37)
    clojure.lang.Compiler$LetExpr$Parser.parse (Compiler.java:5883)
    clojure.lang.Compiler.analyzeSeq (Compiler.java:6455)
    clojure.lang.Compiler.analyze (Compiler.java:6262)
    clojure.lang.Compiler.analyzeSeq (Compiler.java:6443)
    clojure.lang.Compiler.analyze (Compiler.java:6262)
    clojure.lang.Compiler.analyze (Compiler.java:6223)
    clojure.lang.Compiler$BodyExpr$Parser.parse (Compiler.java:5618)
    clojure.lang.Compiler$FnMethod.parse (Compiler.java:5054)
    clojure.lang.Compiler$FnExpr.parse (Compiler.java:3674)
    clojure.lang.Compiler.analyzeSeq (Compiler.java:6453)
    clojure.lang.Compiler.analyze (Compiler.java:6262)
    clojure.lang.Compiler.analyzeSeq (Compiler.java:6443)
    clojure.lang.Compiler.analyze (Compiler.java:6262)
    clojure.lang.Compiler.access$100 (Compiler.java:37)
    clojure.lang.Compiler$DefExpr$Parser.parse (Compiler.java:518)
    clojure.lang.Compiler.analyzeSeq (Compiler.java:6455)
    clojure.lang.Compiler.analyze (Compiler.java:6262)
    clojure.lang.Compiler.analyzealyze (Compiler.java:6223)
    clojure.lang.Compiler.eval (Compiler.java:6515)
```

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@rix0rrr