CS 696 Functional Programming and Design
Fall Semester, 2015
Doc 18 Background & Reagent Intro
Nov 10, 2015

Web Development

Static Pages

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <meta>
        <title>
            Sample
        </title>
    </head>
    <body>
        <h1>
            Hello World
        </h1>
        <p>
            This is a small page
        </p>
    </body>
</html>
```

Issues

Presentation

Dynamic generation

Client side interaction

Presentation - CSS

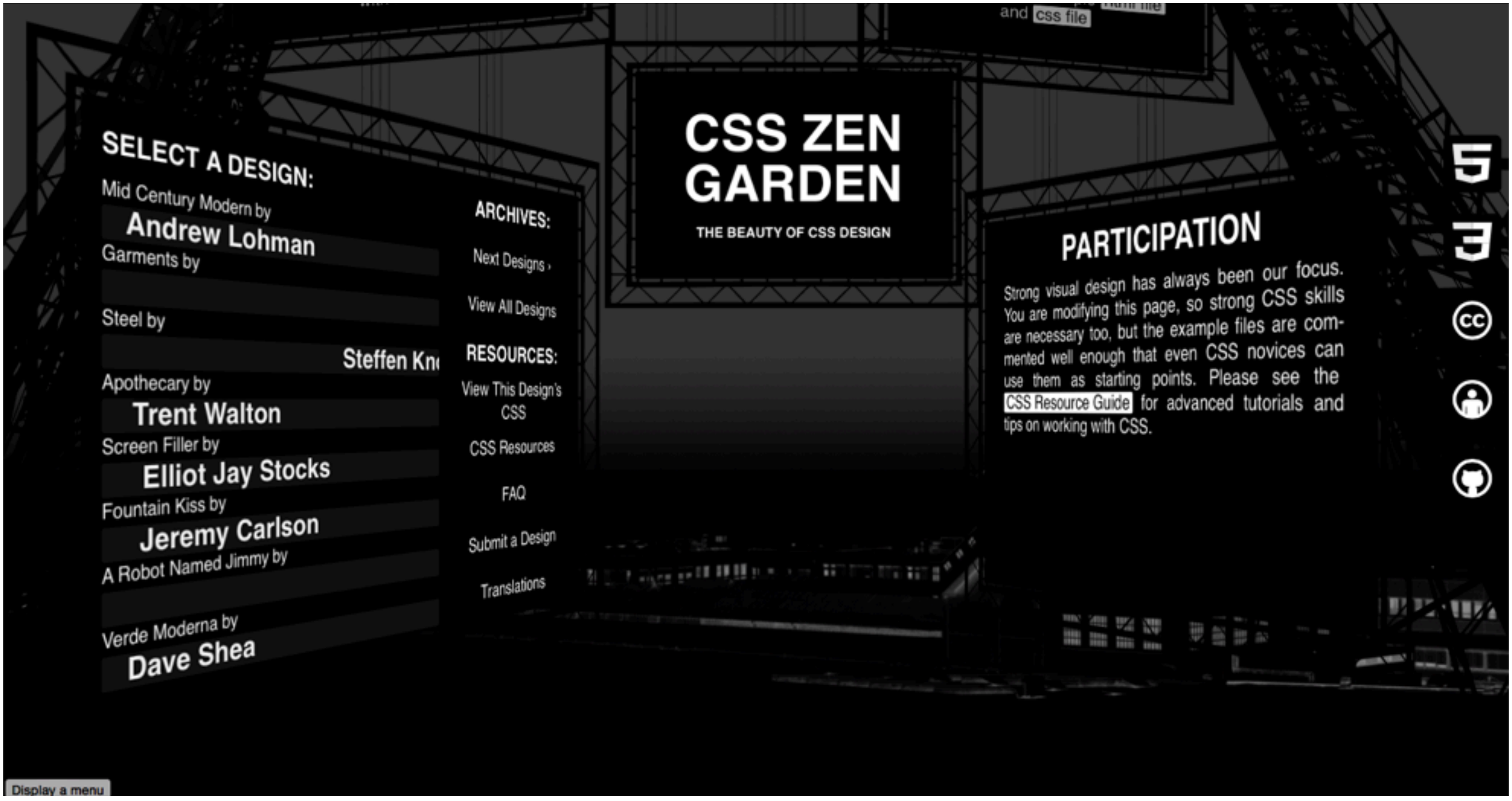
Cascading Style Sheets

Use CSS for layout
Use HTML for structure

http://www.w3schools.com/css/

```
p.code
{
   margin: 0 .5in 0 .5in;
   padding: 5px;
   border-style: solid;
   border-width: 1px;
   border-color: #CCCCCC;
   background-color: #F4F4F4;
}
```

http://www.csszengarden.com/219/



http://www.csszengarden.com/217/

Dynamic Generation of HTML

List of animals in database

How to create an HTML list

```
<ol>
    <li>Bat</li>
    <li>Cat</li>
    <li>Dog</li>
    <li>Elephant</li>
</ol>
```

Embed a language in HTML

Template System

PHP
Selmer

```
{% for ex in exams %}
  <tr>
    <td>{{ex.title}}</td>
   <td>{{ex.exam_date}}</td>
   <td>{{ex.exam_start_time}} - {{ex.exam_end_time}}</td>
   <td>{{ex.exam_location}}</td>
   <td>{{ex.term}}</td>
   <td>{{ex.register_start}} to {{ex.register_end}}</td>
   <td>{{ex.pass_grade}}</td>
  </tr>
  {% endfor %}
```

Generate HTML in your Programming Language

```
(h/html [:ol
        (for [x animals]
          [:li x])])
```

```
<ol>
    <li>Bat</li>
    <li>Cat</li>
    <li>Dog</li>
    <li>Elephant</li>
</ol>
```

HTML

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <meta>
        <title>
            Sample
        </title>
    </head>
    <body>
        <h1>
            Hello World
        </h1>
        <p>
            This is a small page
        </p>
    </body>
</html>
```

Hello World

This is a small page

Tags & Attributes

```
<a href="http://www.eli.sdsu.edu">Me</a>

<img src="w3schools.jpg" width="104" height="142">

<h1>This is a heading</h1>
<h2>This is a heading</h2>
<h3>This is a heading</h3>

<p>This is<br>a para<br>graph with line breaks</p>

<body style="background-color:lightgrey">

<p><b>This text is bold</b>.</p>
```

HTML Tutorial

http://www.w3schools.com/html/default.asp

CSS

```
<!DOCTYPE html>
<html>
<head>
<style>
body {background-color:lightgrey}
h1   {color:blue}
p    {color:green}
</style>
</head>
<body>

<h1>This is a heading</h1>
<p>This is a paragraph.</p>

</body>
</html>
```

div - Container element

```
<div style="background-color:black; color:white; padding:20px;">
    <h2>Hello</h2>
    <p>Here is a sentence</p>
</div>
```

CSS classes

HTML elements can have multiple classes

```
<!DOCTYPE html>
<html lang="en">
    <head>
    </head>
    <body>
    <p>A Clojure example </p>
    <p class="code">(-> 1000 factorial str count)</p>
    </body>
</html>
```

p.code

```
{
   margin: 0 .5in 0 .5in;
   padding: 5px;
   border-style: solid;
   border-width: 1px;
   border-color: #CCCCCC;
   background-color: #F4F4F4;
}
```

Attribute id

ids should be unique in a document

```
<p id="sam" >2</p>
<a id="pete">4</a>
```

```
p#sam { color: lightblue }
```

CSS Tutorial

http://www.w3schools.com/css/

Hiccup

Hiccup

Clojure library representing HTML in Clojure

Vectors represent elements

Maps represent an element's attributes

```
[:p "Hello World"]

[:a {:href "http://www.eli.sdsu.edu"} "Me"]
```

```
(h/html [:p "Hello World"])
```

```
"<p>Hello World</p>"
```

```
(h/html [:a {:href "http://www.eli.sdsu.edu"} "Me"])
```

```
"<a href=\"http://www.eli.sdsu.edu\">Me</a>"
```

```
(def animals ["Bat" "Cat" "Dog" "Elephant"])
(h/html [:ol
        (for [x animals]
          [:li x])])
```

```
"<ol><li>Bat</li><li>Cat</li><li>Dog</li><li>Elephant</li></ol>"
```

Basic Syntax

[tag & body]
[tag attributes & body]

First item must be a tag

Second item can be map
- Attribute

Body
- String
- Nested tag vectors

```
[:a {:href "http://www.eli.sdsu.edu"} "Me"]
```

```
[:p "Hello " [:em "World!"]]
```

Tags

Symbol
String
Keyword

['p "Hello " "World"]

["p" "Hello " "World"]

[:p "Hello " "World"]

Expanding seqs

seqs are expanded in body

```
[:div (list "Hello" "World")]          [:div "Hello" "World"]

[:p (if (< x 5) "Hi" "bye")]           [:p "Hi"]      or      [:p "bye"]

[:p [(if (< x 5) :em :italic) "cat"]]  [:p [:em "cat"]]      or
                                       [:p [:italic "cat"]]
```

```
(def animals ["Bat" "Cat" "Dog" "Elephant"])
(h/html [:ol
        (for [x animals]
          [:li x])])
                    "<ol><li>Bat</li><li>Cat</li><li>Dog</li><li>Elephant</li></ol>"
```

Class & ID

```
[:div {:class "selected"} [:p "hi"]]
```

```
[:div.selected [:p "hi"]]
```

```
[:div {:id "pete"} [:p "hi"]]
```

```
[:div#pete [:p "hi"]]
```

Single Page Application
SPA

Document Object Model (DOM)

Web browsers convert HTML page into a tree of objects

Objects have methods & can be changed

DOM is used to display the page

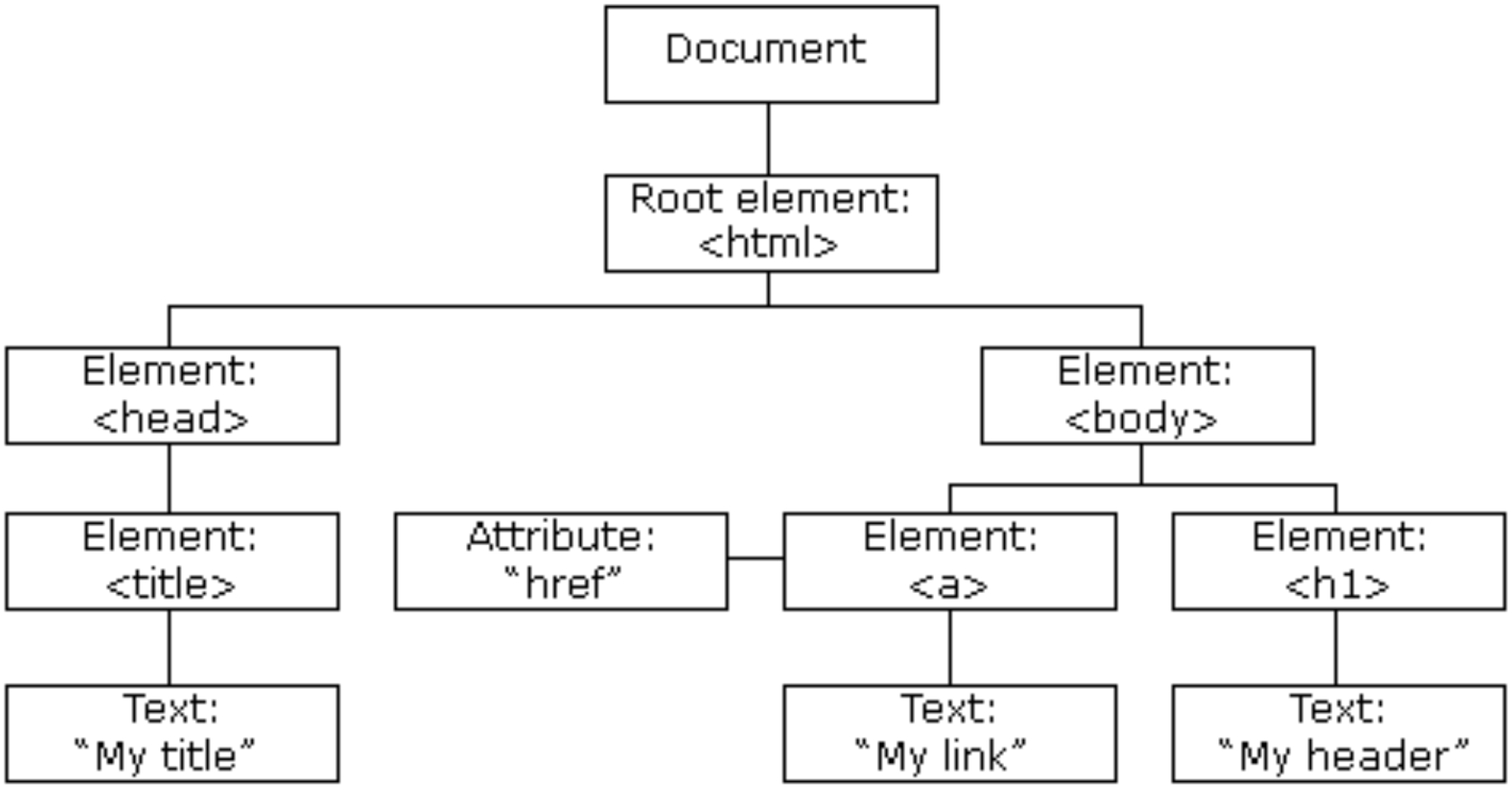


Image from http://www.w3schools.com/js/js_htmldom.asp Accessed 11/8/2015

DOM & JavaScript

JavaScript can add, change, and remove all the HTML elements and attributes in the page
JavaScript can change all the CSS styles in the page
JavaScript can react to all existing events in the page
JavaScript can create new events in the page

https://en.wikipedia.org/wiki/Document_Object_Model

Single Page Application (SPA)

Web application that fits on a single web page

All required resources (HTML, CSS, JavaScript) loaded
- First page load
- In background as needed

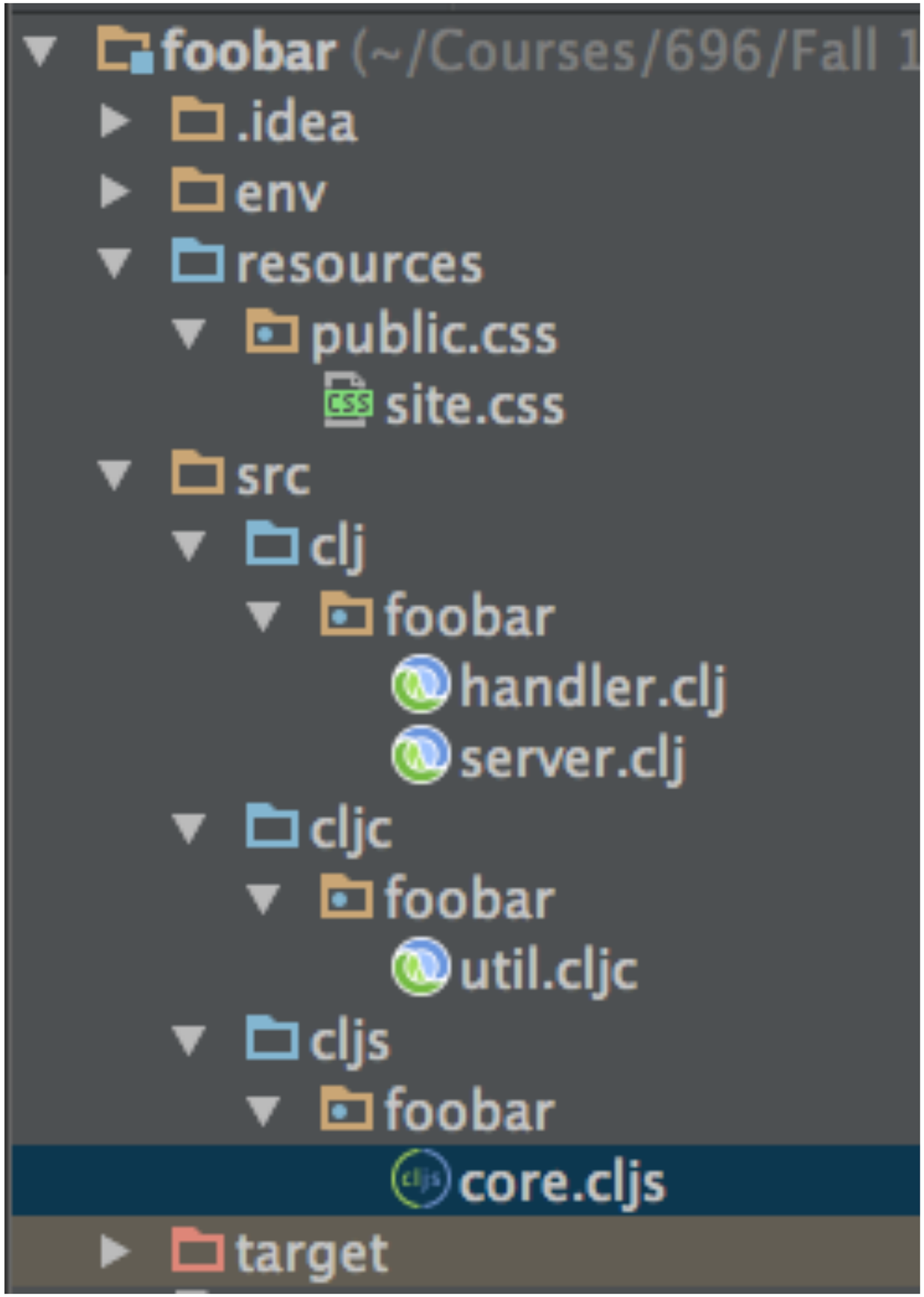
More native app like experience
- No round trip requests for next page
- Menus, buttons, drag&drop handled on client
- Client can redraw any part of the screen

Supports multiple URLs
- Bookmarking
- Google indexing

Reagent

First Project

lein new reagent projectname



clj - handler

```
(def mount-target
  [:div#app
     [:h3 "ClojureScript has not been compiled!"]
     [:p "please run "
      [:b "lein figwheel"]  " in order to start the compiler"]])

(def loading-page
  (html
   [:html
    [:head
     [:meta {:charset "utf-8"}]
     [:meta {:name "viewport"
             :content "width=device-width, initial-scale=1"}]
     (include-css (if (env :dev) "css/site.css" "css/site.min.css"))]
    [:body
     mount-target
     (include-js "js/app.js")]]))

(defroutes routes
  (GET "/" [] loading-page)
  (GET "/about" [] loading-page)
```

defroutes

```
(defroutes routes
  (GET "/" [] loading-page)
  (GET "/about" [] loading-page))
```

Method
GET
POST

URL

URL
parameters

Function to call
When URL is requested

Generate HTML

Hiccup to define page

```
(def loading-page
  (html
   [:html
    [:head
     [:meta {:charset "utf-8"}]
     [:meta {:name "viewport"
             :content "width=device-width, initial-scale=1"}]
     (include-css (if (env :dev) "css/site.css" "css/site.min.css"))]
    [:body
     mount-target
     (include-js "js/app.js")]]))
```

id

Client will replace this if working correctly

```
(def mount-target
  [:div#app
     [:h3 "ClojureScript has not been compiled!"]
     [:p "please run "
      [:b "lein figwheel"]
     " in order to start the compiler"]])
```

Client-Side Libraries

accountant.core

ClojureScript library to make navigation in single-page applications simple

secretary.core

Defines client side routes

URLs & function to call

reagent.session

Just an atom

Used to store state

```
(defn home-page []
  [:div [:h2 "Welcome to foobar"]
   [:div [:a {:href "/about"} "go to about page"]]])

(defn about-page []
  [:div [:h2 "About foobar"]
   [:div [:a {:href "/"} "go to the home page"]]])

(defn current-page []   [:div [(session/get :current-page)]])

(secretary/defroute "/" []
  (session/put! :current-page #'home-page))

(secretary/defroute "/about" []
  (session/put! :current-page #'about-page))

(defn mount-root []
  (reagent/render [current-page] (.getElementById js/document "app")))

(defn init! []
  (accountant/configure-navigation!)
  (accountant/dispatch-current!)
  (mount-root))
```

Client Side

Hiccup for HTML

```
(defn home-page []
  [:div [:h2 "Welcome to foobar"]
   [:div [:a {:href "/about"} "go to about page"]]])

(defn about-page []
  [:div [:h2 "About foobar"]
   [:div [:a {:href "/"} "go to the home page"]]])
```

Routes

```
(secretary/defroute "/" []
  (session/put! :current-page #'home-page))

(secretary/defroute "/about" []
  (session/put! :current-page #'about-page))
```

For each URL

Change atom to hold reference to which function to call

```
(defn current-page []   [:div [(session/get :current-page)]])
```

Lists are expanded in Hiccup
So expands to the current page

```
(defn mount-root []
  (reagent/render [current-page] (.getElementById js/document "app")))
```

Magic function
Render the client page each time current-page changes