Client-server Web applications with Ocsigen

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Pierre Chambart, Grégoire Henry

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Example:
a drawing application

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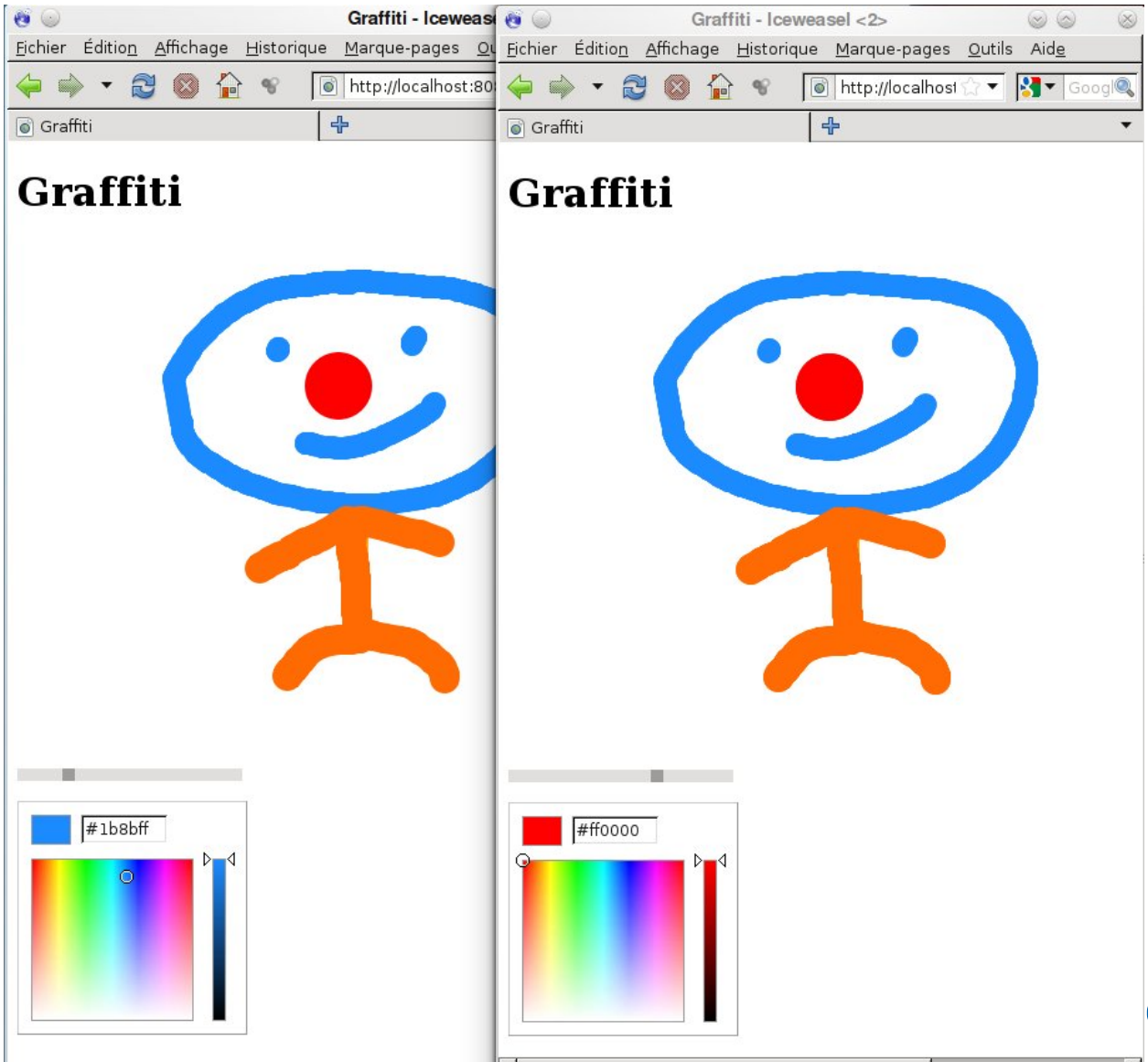
a collaborative drawing application



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The code

The full *Graffiti* program

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
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let b = Eliom_bus.create ~name:"graff" Json.t<messages>

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  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
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- short

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Reliability

- Take in charge many security issues
- Reduce bugs by sophisticated static typing

$\Rightarrow$ The compiler helps you to write good code

$\Rightarrow$ Easy maintenance and evolution

The language

OCaml

- Very expressive: functional, object oriented, parametrized modules …
- Very rich type system (static typing!)
- Compiled language (fast)
- Extensible syntax
- Rich set of libraries and bindings
- Community of users, industrial users

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compiled to JS

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    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
         << <html> <head> <title>Graffiti</title>
                          <link rel="stylesheet" href="./css/style.css"/>
                          <script src="./oclosure.js"></script>
                  </head>
                  <body> <h1>Graffiti</h1> </body>
            </html> >>
```

open, constants, type

Initializing the application Bus

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
         << <html> <head> <title>Graffiti</title>
                          <link rel="stylesheet" href="./css/style.css"/>
                          <script src="./oclosure.js"></script>
                  </head>
                  <body> <h1>Graffiti</h1> </body>
            </html> >>
```

open, constants, type

Initializing the application Bus

draw function

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
       << <html> <head> <title>Graffiti</title>
                        <link rel="stylesheet" href="./css/style.css"/>
                        <script src="./oclosure.js"></script>
                 </head>
                 <body> <h1>Graffiti</h1> </body>
          </html> >>
```

open, constants, type

Initializing the application Bus

draw function

Service

ocsigen

fresh air in web programming

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
       << <html> <head> <title>Graffiti</title>
                        <link rel="stylesheet" href="./css/style.css"/>
                        <script src="./oclosure.js"></script>
                 </head>
                 <body> <h1>Graffiti</h1> </body>
          </html> >>
```

HTML5 page

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
       << <html> <head> <title>Graffiti</title>
                        <link rel="stylesheet" href="./css/style.css"/>
                        <script src="./oclosure.js"></script>
                 </head>
                 <body> <h1>Graffiti</h1> </body>
          </html> >>
```

Page specific code

HTML5 page

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
       << <html> <head> <title>Graffiti</title>
                        <link rel="stylesheet" href="./css/style.css"/>
                        <script src="./oclosure.js"></script>
                 </head>
                 <body> <h1>Graffiti</h1> </body>
          </html> >>
```

Canvas

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
         << <html> <head> <title>Graffiti</title>
                          <link rel="stylesheet" href="./css/style.css"/>
                          <script src="./oclosure.js"></script>
                  </head>
                  <body> <h1>Graffiti</h1> </body>
            </html> >>
```

Canvas

Slider

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
       << <html> <head> <title>Graffiti</title>
                        <link rel="stylesheet" href="./css/style.css"/>
                        <script src="./oclosure.js"></script>
                 </head>
                 <body> <h1>Graffiti</h1> </body>
          </html> >>
```

Canvas

Slider

Color picker

ocsigen

fresh air in web programming

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_appl (struct
    let application_name = "graffiti"
  end)

let b = Eliom_bus.create ~name:"graff" Json.t<messages>

{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
    ctx##stroke()
}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
         (Js.null, Js.null, Js.some (Js.string "goog-hsv-palette-sm")) in
       pSmall##render(Js.some Dom_html.document##body);

       let x = ref 0 and y = ref 0 in
       let set_coord ev =
         let x0, y0 = Dom_html.elementClientPosition canvas in
         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
       in
       let (b : messages Eliom_bus.t) = %b in
       let line ev =
         let v = compute_line ev in
         let _ = Eliom_bus.write b v in
         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
                    >>> first [mousemoves Dom_html.document (arr line);
                               mouseup Dom_html.document >>> (arr line)])) ());
    }};

     Lwt.return
       << <html> <head> <title>Graffiti</title>
                        <link rel="stylesheet" href="./css/style.css"/>
                        <script src="./oclosure.js"></script>
                 </head>
                 <body> <h1>Graffiti</h1> </body>
          </html> >>
```

Canvas

Slider
Color picker

Function
to compute coordinates
and send them to the server

Structure

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
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       canvas##width <- width; canvas##height <- height;
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       let slider = jsnew Goog.Ui.slider(Js.null) in
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         x := ev##clientX - x0; y := ev##clientY - y0 in
       let compute_line ev =
         let oldx = !x and oldy = !y in
         set_coord ev;
         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
         (color, size, (oldx, oldy), (!x, !y))
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     Lwt.return
       << <html> <head> <title>Graffiti</title>
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                 </head>
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Canvas

Slider
Color picker

Function
to compute coordinates
and send them to the server

Reacting to server events

Structure

```
{shared{
  open Eliom_pervasives
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                    (arr (fun ev -> set_coord ev; line ev)
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```
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```

open, constants, type

Initializing the application
Bus

draw function

Service

Canvas

Slider
Color picker

Function
to compute coordinates
and send them to the server

Reacting to server events
Mouse events

HTML5 page

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Service based Web programming
Generating valid HTML
Client/server Web applications
Sessions, scope of server side state
Mixing Ocsigen apps with traditional Web interaction

Services

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```
let main_service = register_service
                     ~path:[""]
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Services

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```
let main_service = register_service
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```

- HTML
- File
- Redirection
- Action
- Application
- ...

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Service based Web programming

Powerful service identification mechanism

→ *Precise and straightforward implementation of traditional Web interaction*

Services are first class values

→ *No broken links!*

Typing of services parameters

→ *Conformance of links/forms w.r.t. services!*

→ *Automatic translation to OCaml types*

integers, booleans, but even lists or sets.

Dynamic creation of services

→ *Services customized for one operation by one user*

- Service based Web programming
- Generating valid HTML
- Client/server Web applications
- Sessions, scope of server side state
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HTML generation

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```

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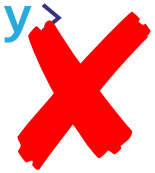
HTML generation

HTML validity checked at compile time!

Producing valid HTML

```
<html>
  <head><title>Hello</title></head>
  <body><h1>Hello</h1></body>
</html>
```

```
<html>
  <head><title>Hello</title></head>
  <body><h1>Hello</h1></body>
</hmtl>
```



→ rejected *at compile time!*

```
<html>
  <head><title>Hello</title></head>
  <body><title>Hello</title></body>
</html>
```

Producing valid HTML

Any program that may generate wrong pages will be rejected by the compiler!

$f : () \rightarrow$ block list

<body> $f()$ </body>

 $f()$

- Service based Web programming
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Client/server applications

```
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    }};

     Lwt.return
       << <html> <head> <title>Graffiti</title>
                        <link rel="stylesheet" href="./css/style.css"/>
                        <script src="./oclosure.js"></script>
                 </head>
                 <body> <h1>Graffiti</h1> </body>
          </html> >>
```

```
{{ ... }}
```

compiled to JS

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The bus

```
let b =
  Eliom_bus.create ~name:"graff" Json.t<messages>
```

```
{shared{
  open Eliom_pervasives
  open HTML5.M
  let width = 700
  let height = 400
  type messages = (string * int * (int * int) * (int * int)) deriving (Json)
}}

module My_appl = Eliom_output.Eliom_mod...(
  struct
    let application_name = "graffiti"
  end)

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{client{
  open Event_arrows
  let draw ctx (color, size, (x1, y1), (x2, y2)) =
    ctx##strokeStyle <- (Js.string color);
    ctx##lineWidth <- float size;
    ctx##beginPath();
    ctx##moveTo(float x1, float y1); ctx##lineTo(float x2, float y2);
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}}

let main_service = My_appl.register_service ~path:[""] ~get_params:Eliom_parameters.unit
  (fun () () -> Eliom_services.onload

    {{ let canvas = Dom_html.createCanvas Dom_html.document in
       let ctx = canvas##getContext (Dom_html._2d_) in
       canvas##width <- width; canvas##height <- height;
       ctx##lineCap <- Js.string "round";
       Dom.appendChild Dom_html.document##body canvas;

       let slider = jsnew Goog.Ui.slider(Js.null) in
       slider##setMinimum(1.); slider##setMaximum(80.);
       slider##render(Js.some Dom_html.document##body);

       let pSmall = jsnew Goog.Ui.hsvPalette
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         let color = Js.to_string (pSmall##getColor()) in
         let size = int_of_float (Js.to_float (slider##getValue())) in
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       let (b : messages Eliom_bus.t) = %b in
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         let v = compute_line ev in
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         draw ctx v
       in
       ignore (Lwt_stream.iter (draw ctx) (Eliom_bus.stream b));
       ignore (run (mousedowns canvas
                    (arr (fun ev -> set_coord ev; line ev)
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    Lwt.return
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```

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The bus

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```
Eliom_bus.write %b v
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```

```
Eliom_bus.write %b v
```

```
Lwt_stream.iter (draw ctx) (Eliom_bus.stream %b)
```

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Mouse events

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       </html> >>
```

```
run (mousedowns canvas
       (arr set_coord >>>
          first [mousemoves document (arr line);
                 mouseup document >>> (arr line)])) ()
```

We use *arrows*


Service based Web programming
Generating valid HTML
Client/server Web applications
Sessions, scope of server side state
Mixing Ocsigen apps with traditional Web interaction

Sessions revisited

Session data saved in *references* with a **scope**.

Scopes:

- Site
- Session group (user)
- Browser session (cookie)
- Client side process (tab)
- Request

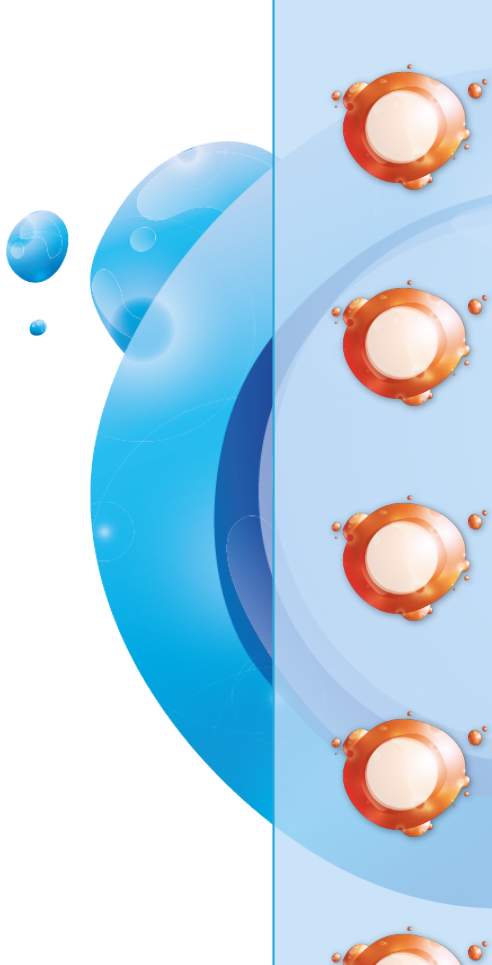
Sessions revisited

Server side state implemented as *references* with a **scope**.

Scopes:

- Site
- Session group (user)
- Browser session (cookie)
- Client side process (tab)
- Request

Services also have a scope.



- Service based Web programming
- Generating valid HTML
- Client/server Web applications
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- Mixing Ocsigen apps with traditional Web interaction

Web 1.0 + Web 2.0 = ?

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The client side program does not stop when you click a link!

Web 1.0 + Web 2.0 = ?

The client side program does not stop when you click a link!

⟶ Ocsigen client/server Web applications are fully compatible with traditional Web interaction (bookmarks, back button)!

⟶ You can keep a state on client side.

⟶ Parts of the page can persist after loading a new page.

⟶ Music/video does not stop.

Example: Music streaming Website

(go to another album without stopping the music)

Conclusion

Many unique features

Many unique features

Dynamic services

Persistance of client side program

Sophisticated service identification

HTML typing

Unified client/server programming

Session services

Scopes

Typing of links, forms, parameters

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Users

A growing community

Some small companies:

BeSport, Cowebo, Hypios, Ocamlcore, Ocamlpro, Baoug, Nleyten …

The project

ocsigen.org

Free/open source software --- Version 2 released in 2011.

Authors and contributors:

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