Exploiting the full power of OCaml in Web programming

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1 Overview

A few words about PPS

Proofs, Programs and Systems

Guy Cousineau, Pierre-Louis Curien, Jérôme Vouillon, Roberto Di Cosmo, ...

Web programming in OCaml

- OCamlnet
- Mod_caml (Cocanwiki ...)
- WDialog
- ASXCaml (?)
- ...

The Ocsigen project

Goal:

Find new programming techniques for the Web

- Improving accessibility and robustness
- High level concepts to simplify programmers work
- Better fitted to Web 2.0

Two projects: Ocsigen and WebSiCoLa
Idea born in 2000. Beginning of implementation: january 2005

The Ocsigen project

One main idea:

continuation based Web programming — Christian Queinnec

Other functional Web programming tools:

Seaside

Links

Hop

Wash

PLT scheme

The Ocsigen project

Ocsigen 1.0 (First step)

- Full-featured Web server
- Eliom: continuation based Web programming
- Ocsimore: more libraries for Ocsigen

`http://www.ocsigen.org`

A free software project

Open source community

Community of users (Web developpers) : Nurpawiki, Lambdium ...

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The Web server

- HTTP protocol
- Powerful extension mechanism
- Static pages
- access control
- Compression of data
- CGI module
- Reverse proxy
- Eliom

Cooperative threads

- Only one thread of execution
- Never use blocking functions: go back to another continuation instead

LWT by Jérôme Vouillon Cooperative threads in monadic style

```
let r = request () in          ↦   request () >>= fun r ->
parse_answer r                     parse_answer r
```

+ preemptive threads for non-cooperative libraries

2 Eliom

2.1 Static typing of pages

Static checking of HTML

Several output modules:

Text	Untyped pages
Xhtml	Type checking with polymorphic variants
OcamlDuce	Type checking with OCamlDuce (XHTML, XML)
CSS	
File	
Redirection	

```
let create_page sp mytitle mycontent =
  Lwt.return
    << <html>
         <head><title>$str:mytitle$</title></head>
         <body><h1>$str:mytitle$</h1>$list:mycontent$</body>
       </html> >>

let create_page2 sp mytitle mycontent =
  Lwt.return
    (html
       (head (title (pcdata mytitle)) [])
       (body ((h1 [pcdata mytitle])::mycontent)))
```

2.2 Functional services

Services

Links/forms = function calls (services)

```
let mainpage = new_service ~path:[] ~get_params:unit ()

let () = register mainpage
    (fun sp () () ->
      Mylib.create_page sp
        "Messages"
        [Mylib.display_message_list ()])


let msgpage = new_service ~path:[] ~get_params:(int "n") ()
```

```
let () = Xhtml.register msgpage
    (fun sp n () ->
      Mylib.create_page sp
        ("Message␣"^(string_of_int n))
        [Mylib.display_message n])
```

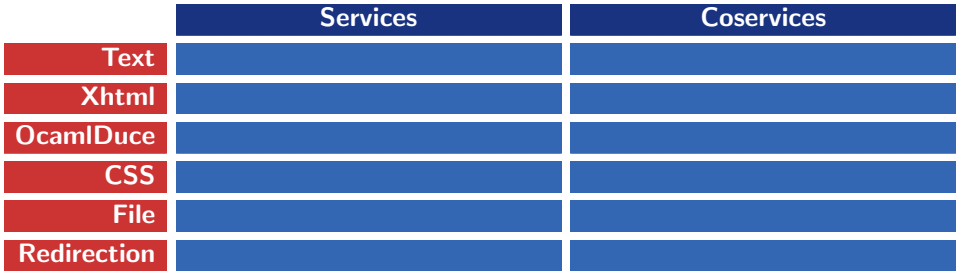
Eliom services
A link towards a service with one `int` parameter:

```
a msgpage sp [pcdata "click"] 4
```

Benefits

- No broken links
- Static checking of the types of parameters

Coservices: Solving the back-button problem
Create dynamically new services




```
let () = register addmsgpage
    (fun sp () msg ->
      let ok =
        new_coservice ~max_use:1 ~fallback:mainpage ~get_params:unit ()
      in
      register ~sp ~service:ok
        (fun sp () () ->
          Mylib.register_message msg;
          Mylib.create_page sp
            "Message␣added"
            [Mylib.display_message_list ()]);
```

```
  Mylib.create_page sp
    "Confirm this Message?"
    [p [pcdata msg];
     p [
     a ok sp [pcdata "Yes"] (); pcdata " ";
     a mainpage sp [pcdata "Cancel"] ()]
    ]
)
```

2.3 Taxonomy of services

Actions
Create dynamically new services

	Services	Coservices
Text		
Xhtml		
OcamlDuce		
CSS		
File		
Redirection		
Action		

Non-attached services
POST and GET parameters
Sessions
Full taxonomy of services

	Services		Coservices	
	attached	non-attached	attached	non-attached
Text				
Xhtml				
OcamlDuce				
CSS				
File				
Redirection				
Action				

+ POST services
+ session services

Example of non-attached services: connection of users

```
let connect_action =
  new_post_service' ~name:"connect" ~post_params:(string "login") ()
let disconnect_action =
  new_post_service' ~name:"disconnect" ~post_params:unit ()

let () = Actions.register disconnect_action
    (fun sp () () ->
      Eliomsessions.close_session ~sp () >>= fun () ->
      Lwt.return [])

let () = Actions.register connect_action
    (fun sp () login ->
      Eliomsessions.close_session ~sp () >>= fun () ->
      Eliomsessions.set_volatile_data_session_group
          ~set_max:(Some 10) ~sp login;
      Lwt.return [])
```

Conclusion

Summary of Eliom's concepts

- Static checking of pages
- Full set of service kinds
  - Strong use of continuation based Web programming
  - Very precise control of URLs
  - Highly related to concrete needs of Web developers
  - Reduces by a lot the number of lines of code
  - No dead links
  - Typing of page parameters and forms
- Automatic sessions
  - Automatic cookie management
  - Session coservices
  - Timeouts
  - Session data (persistent or not)
  - Garbage collection of data
  - Session groups

Future

Version 1 (a few weeks).
Then:

- Higher level features for Eliom
- High level layout for Web sites
- Organizing data. Content management
- Executing code on the client
  - Writing a distributed program in OCaml
  - Checking the correctness of a client side program with respect to a Web site
  - ...